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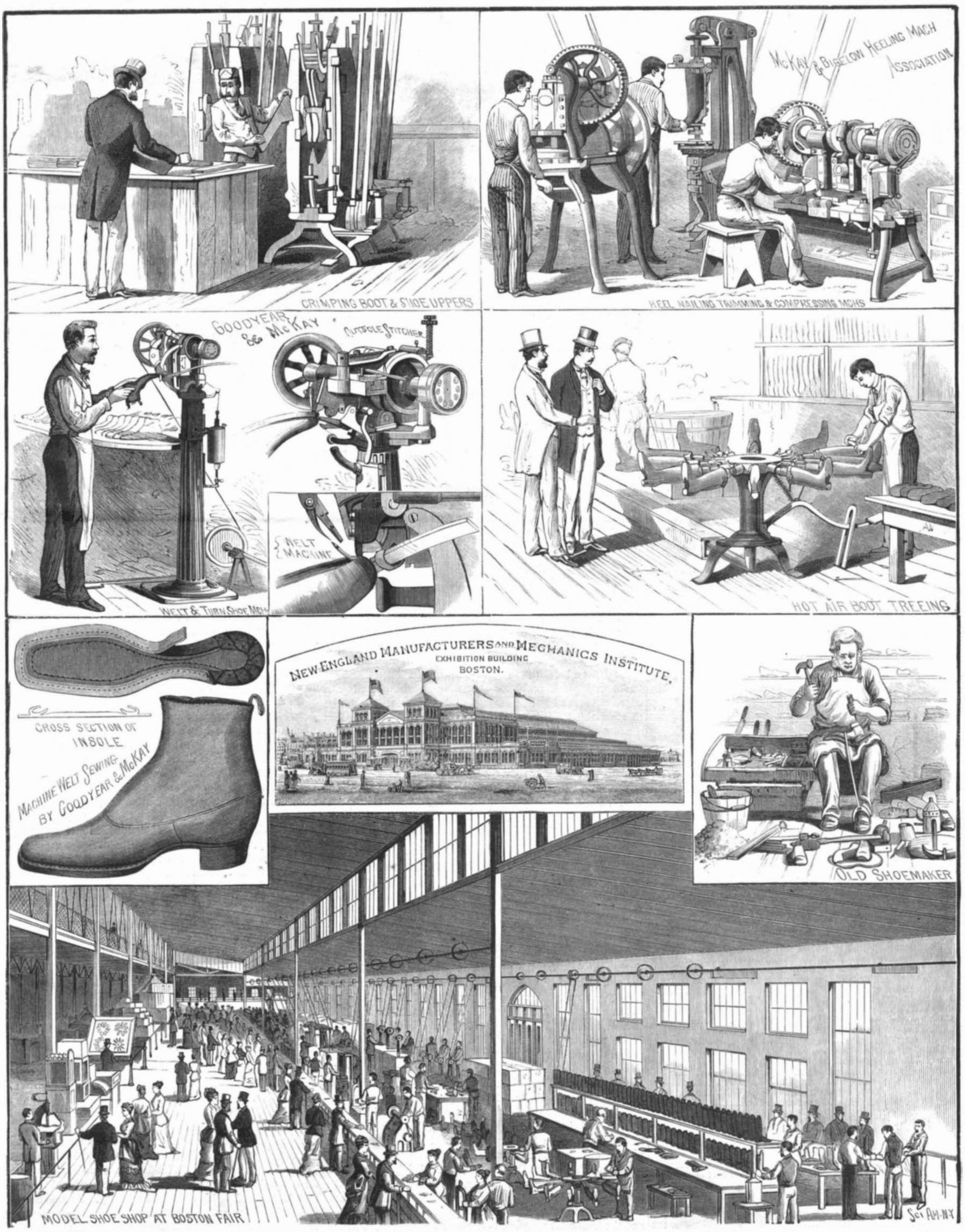
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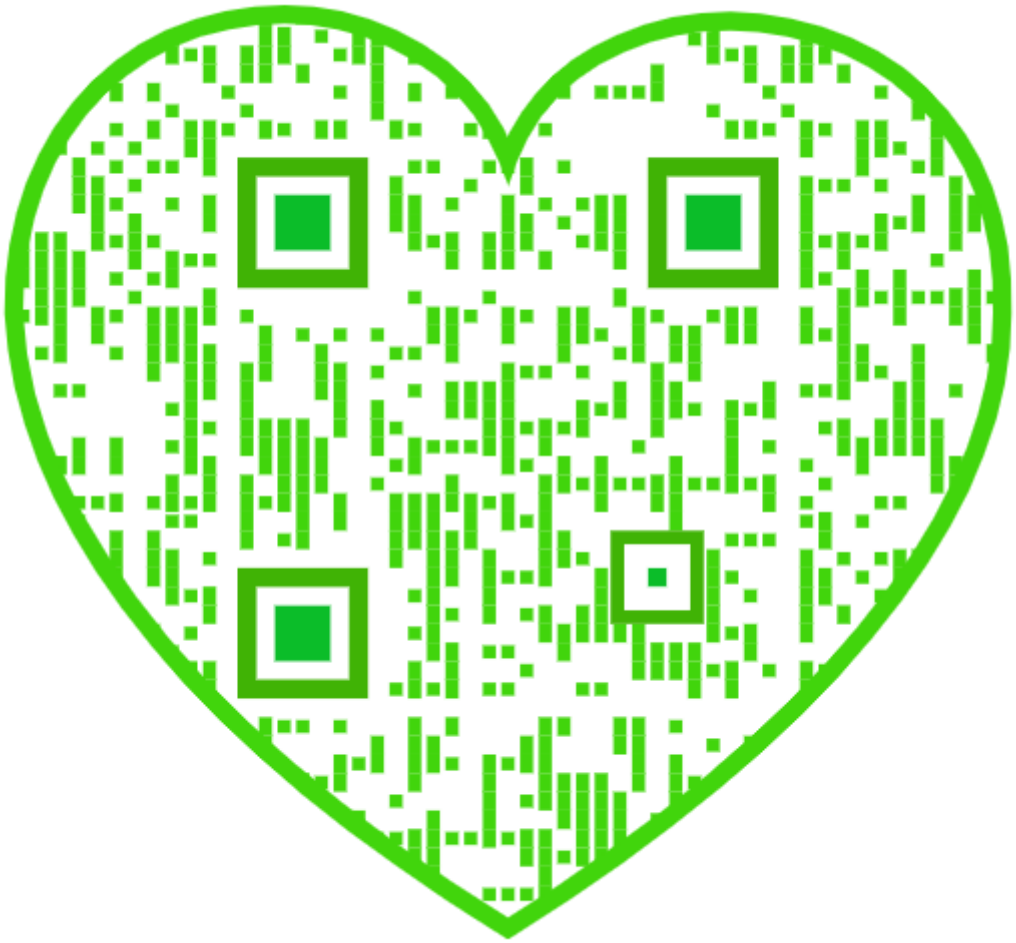

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NEW YORK, SATURDAY, OCTOBER 8, 1881.

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THE STORAGE OF PETROLEUM.

There is at present, in round numbers, 25,000,000 barrels of crude petroleum stored in iron tanks in the oil regions of Pennsylvania. It is an inland lake of oil that may be described as having reached its highest ebb, inasmuch as indications now point unmistakably to a falling off in the daily production of the wells and a consequent decline in the amount tanked. Not the least striking feature of the oil regions are the clusters of these enormous iron reservoirs, located on hill and in valley, and whose construction keeps actively employed great workshops and an army of men in Pittsburg, Titusville, Pa., Oil City, Pa., and elsewhere. The oil held by the 1,800 tanks dotting the oil regions would fill to a depth of ten feet a square reservoir or lake measuring 3,747 feet each way.

Tank building as an industry dates back to 1861, when the firm of Carroll & Snyder, of Pittsburg, were called upon to put up what was then considered a large tank, 4,500 barrels capacity. There were grave doubts whether the pressure of the liquid inside would not burst the tank, and the iron plates forming its bottom and sides were made heavier than is now considered necessary in a 35,000 barrel tank. When the tank was finally tested—with water—the spectators kept at a respectful distance until their doubts were dispelled by the water's appearance over the brim. The tank stood like a rock, and is still in existence and doing service at Natrona, 25 miles from Pittsburg. From that time the success of iron tanks in storing petroleum was assured. In capacity they were yearly increased, until to-day few if any storage tanks hold less than 25,000 barrels, while the majority of those lately contracted for hold 35,000 barrels. These monsters when set up cover as much ground as a circus tent. All are perfectly circular in form, with perpendicular sides and flat top. The largest have a diameter of 94 feet, and are 28 feet high. The iron plates in these vary from three-eighths of an inch to three-sixteenths of an inch thick, according to the locality of the plates in the make-up of the tank, those nearer the bottom, of course, having to withstand the greatest strain from the confined oil. This pressure, in a 35,000 barrel tank (filled), will equal a tensile strain of 7,000 pounds on an inch width of metal surrounding the lowest portion of such tank. The cost, at the present rates of iron, for these storehouses of nature's oil is as follows: For a 35,000 barrel capacity, 28 cents per barrel, or $9,800; a 30,000 barrel capacity, 27 cents, or $9,450; and a 25,000 barrel capacity, 30 cents, or $7,500. The largest sized tank when ready for oil will weigh 93 tons. In their construction very little skilled labor is required, except when "setting up." Improved automatic machinery cuts, bends, and punches the plates with extreme rapidity and accuracy, so that on being set up every one of the 200 plates with their rivet holes is found in its appointed place. The three lowest "rings" of plates, it might be added, are double riveted. Before the use of plate iron in tank building, wood or wood and iron were used, and to prevent such tanks from leaking was almost impossible, this difficulty increasing with their capacity.

Of the 25,000,000 barrels of petroleum now stored in tanks fully one-half is owned by the United Pipe Lines (Standard Oil Company), the balance being owned by other pipe lines and by private parties. A single banking firm of New York owns a half million barrels stored in Pittsburg built tanks and awaiting better prices. The growth of this enormous stock of oil has been as follows, according to the most reliable statistics—the barrels are of 42 gallons each: August 31, 1878, 4,599,362 barrels; 1879, 7,620,525; 1880, 15,063,651; July 31, 1881, 24,888,337; August 31 (estimated), 25,000,000.

Until very recently only crude petroleum was tanked, but at present a Pittsburg builder is at work on iron tanks for the Standard Company for the storage of refined oil at Louisville, Cleveland, Chicago, Indianapolis, St. Louis, etc. To retain this searching fluid requires an extremely tight and well built tank.

PRESIDENT GARFIELD'S FATAL WOUND.

President Garfield was shot on the morning of July 2, while passing through the Baltimore and Potomac Railway Station in Washington. The assassin—previously known as a petty swindler and disappointed office seeker—fired two shots from a heavy pistol, one ball taking effect.

The wound was expected to be immediately fatal, and during the first day the physicians sought only to diminish the more alarming symptoms by administering stimulants and hypodermic injections of morphia and atropia. In the evening the patient rallied a little and a superficial examination was made. The bullet entered the body about two inches to the right of the fourth lumbar vertebra, between the tenth and eleventh ribs. It was mistakenly assumed that it passed through the liver and lodged somewhere in the front wall of the peritoneal cavity. From the supposed nature of the wound the attending physicians thought that death would ensue before midnight. The President did not die, and the expected symptoms of peritonitis and those which should have followed a serious lesion of the liver, kidney, or intestines did not appear.

On the 4th of July, Dr. Agnew, of Philadelphia, and Dr. Hamilton, of New York, were called in consultation. No thorough surgical exploration of the wound appears to have been made, or indeed was possible or justifiable at that time, and the treatment proceeded on the, as it proved, entirely mistaken diagnosis first made.

By the latter part of the month symptoms indicating pus poisoning were apparent. On the morning of the 24th, Dr. Agnew opened a pus cavity, which had formed a few inches below where the ball entered, and removed a splinter of bone. It was now evident that the ball had struck a rib—the eleventh, breaking it in two places; and it was inferred that it had been deflected downward. Its actual course, however, remained undetermined. Relieved by the better drainage of the wound the President seemed to improve slightly. Another operation was performed by Dr. Agnew, August 8, but its nature and purpose have not been made public. During the ensuing week the decline was steady, if not rapid, and then a more hopeful period set in. This was broken by the appearance of an abscess in the right parotid gland, August 18, followed by trouble in the lungs and a distressing cough. Since the operation of the 8th the patient's stomach had been greatly disturbed and intolerant of food.

The patient's desire to get away from Washington had been persistent, and by the first week in September it was apparent that it was useless to wait for improvement before making the attempt to remove him. Foreseeing speedy death if he remained, it was decided as a last resort to attempt the journey to Elberon, near Long Branch, by the sea. The removal was accomplished September 6, but was unavailing. The sight of the ocean helped to soothe the remaining days of the President's life, but the inevitable end came on the night of Monday, September 19.

The *post-mortem* examination revealed the not unexpected fact that the wound was in all probability fatal at the outset, and the surprising fact that throughout the physicians had been entirely at fault touching the course and position of the deadly bullet. The official report of the autopsy, dated 11 P.M., September 20, runs as follows:

"By previous arrangement a *post-mortem* examination of the body of President Garfield was made this afternoon in the presence and with the assistance of Drs. Hamilton, Agnew, Bliss, Barnes, Woodward, Reyburn, Andrew H. Smith of Elberon, and Acting Assistant Surgeon D. S. Lamb, of the Army Medical Museum, Washington. The operation was performed by Dr. Lamb. It was found that the ball, after fracturing the right eleventh rib, had passed through the spinal column in front of the spinal canal, fracturing the body of the first lumbar vertebra, driving a number of small fragments of bone into the adjacent soft parts, and lodging below the pancreas, about two inches and a half to the left of the spine, and behind the peritoneum, where it had become completely encysted. The immediate cause of death was secondary hemorrhage from one of the mesenteric arteries adjoining the track of the ball, the blood rupturing the peritoneum, and nearly a pint escaping into the abdominal cavity. This hemorrhage is believed to have been the cause of the severe pain in the lower part of the chest complained of just before death.

"An abscess cavity, six inches by four in diameter, was found in the vicinity of the gall bladder between the liver and the transverse colon, which were strongly adherent. It did not involve the substance of the liver, and no communication was found between it and the wound. A long supplementary channel extended from the external wound between the loin muscles and the right kidney almost to the right groin. This channel, now known to be due to the burrowing of the pus from the wound, was supposed during life to have been the track of the ball.

On examination of the organs of the chest evidences of severe bronchitis were found on both sides, with bronchopneumonia of the lower portions of the right lung, and, though to a much less extent, of the left. The lungs contained no abscesses, and the heart no clots. The liver was enlarged and fatty, but free from abscesses. Nor were any found in any other organ except the left kidney, which contained near its surface a small abscess about one-third of an inch in diameter.

"In reviewing the history of the case in connection with the autopsy, it is quite evident that the different suppurating surfaces, and especially the fractured, spongy tissue of the vertebræ, furnish a sufficient explanation of the septic condition which existed.

(Signed)

D. W. BLISS. FRANK H. HAMILTON.
J. K. BARNES. D. HEYES AGNEW.
J. J. WOODWARD. ANDREW H. SMITH.
ROBERT REYBURN. D. S. LAMB."

HEAT, SUN STORMS, AND YELLOW LIGHT.

The first week in September was characterized by a number of days of extremely hot weather, the temperature in this city rising above 100° Fah. During the days of greatest heat the sun appeared to be greatly disturbed by storms. Whether the terrestrial high temperature was due to the direct action of solar disturbances, or to the forest fires then raging in Michigan, or to the indirect effect upon our atmosphere of the volumes of smoke which darkened the sky over many thousands of square miles, it is impossible to decide. The phenomena apparently connected with the smoky condition of the air were sufficiently marked to make the week a memorable one. On the 5th and 6th a peculiar yellow haze overspread the land from Canada to the Atlantic coast, deepening in many places to brown and black, so that lamps had to be lighted at mid-day. In this city the yellow haze was noticeable, but not so dense as elsewhere. At Saratoga the ghastly yellow appearance of the atmosphere increased to the positive shade of an orange lily, and it was next to impossible to recognize a person at no greater dis-

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tance than the width of Broadway (125 feet). Between 8 and 9 o'clock A. M. it grew still darker, and many predicted another "dark day" similar to the one chronicled in the early part of the century. The hotels and stores were lighted just as at night, and the peculiarity of the jets was that they resembled the cold, silver color of electric lamps, but of much less power. Another effect produced by the inexplicable state of the atmosphere was the extremely bright green appearance of the lawns and foliage. This was especially noticeable from the fact that the shades of everything else were of a decidedly subdued color. During the early forenoon, outside of the regular routine, business and pleasure were practically suspended. So dark was it at 9 o'clock that when the American Social Science Association met in Putnam Hall every gas jet had to be lighted, and it bore the appearance of an evening entertainment. The extreme humidity of the atmosphere was the subject of general remark, and several who had taken an early drive into the country stated that their clothing was as damp as if they had passed through a shower. The darkness lifted about noon.

At Toronto the darkness continued all day, though as the day advanced the yellow of the sky was brightened to a rich orange hue. In northern New York the atmosphere was of a greenish yellow hue. At Lake Placid, in the Adirondacks, a greenish fog covered the country; the grass seemed artificially colored, the animals had a sea-green color, the mountains disappeared, and in their place were wreaths of green vapor; the clouds were yellowish green; the sun appeared a ball of golden fire through the mist, and all nature seemed to have a strange and mysterious hue. Some people when they rose in the morning feared that their own eyes were jaundiced; others thought that some strange calamity was at hand, some great convulsion of nature; people in many places were in a state of anxiety and dread.

The Boston *Journal* of the 7th compared the previous day with the famous Black Friday of 1780. No fog or haze was perceptible, except when looking off toward the horizon from an elevated position, but the sun was thoroughly obscured, and the atmosphere was pervaded with a yellowish light which lent a strange appearance to every object. There was a weird luster to the surface of the streets and the fronts of the buildings. This aspect of the sky was such that some timorous people's minds were directed by it to the scriptural prophecy concerning the brassy appearance of the sky which is to be one of the features of the "last day." The interiors of buildings grew dark as the day advanced, and the outer air as viewed through a window seemed to be pervaded with the reflected light from some vast conflagration. It became necessary to light the gas in stores and offices, and the jets admitted a white flame that strongly resembled the electric light. The faces of people in the street were of a deep saffron color, as if jaundice had begun to show its work in complexions tanned by a summer of exposure to wind and sun, and some skins even displayed the tint of those yellow beach shoes which have of late come into fashion. A few buff dresses seemed as yellow as dull gold, and the grass took on a rank and metallic hue like verdigris. The phenomenon became more marked in the afternoon than it was during the forenoon. As late as 1 o'clock it was possible for a person sitting near a window to see to read or write without the aid of artificial light, but after that hour the gloom deepened rapidly, the sky grew still more brazen in appearance, and the gloom was that of late twilight. The front windows of stores on Washington street were illuminated as at night, and there was not a single usual aspect of the daytime to be seen in any direction. There was something terrible in the scene, and it is not to be wondered at if some weak minds allowed themselves to be tormented by fears of what the extraordinary event might presage. The climax was reached at about 3 o'clock, and after that light began gradually to return, although perfect daylight was not restored. At 5 o'clock, the ruddy glare had disappeared from the sky, and the light, such as it was, seemed more natural than during the day. Before 8 o' clock the moon had come out, the clouds had disappeared, and the atmosphere had resumed its normal condition.

As already remarked, this peculiar disturbance of the atmosphere prevailed throughout New York, the Eastern States, and Canada. The forest fires of Michigan and Canada were most commonly thought to be the immediate cause. Professor Emerson, of Dartmouth College, suggested as an additional agent the pollen from northern fir and pine trees. Others suspected that the excessive moisture of the lower atmosphere might have had something to do with the phenomenon. It is possible, however, that some extra-terrestrial cause may have had a controlling influence; something, for instance, like the band of yellow light which spanned the sky on the night of the 12th. As described by the observer above named at Hanover, N. H., the yellow luminous band was from 5° to 10° in width, quite uniform throughout, and extended from about 20° north of west to 30° south of west, dividing the heavens into northern and southern divisions of about three fifths and two fifths respectively. Its direction was about at right angles with the Milky Way. A very distinctive feature was the regular and definitely marked northern boundary. From 8 P.M. to 8:15 P.M. it remained comparatively fixed. At 8:30 o'clock it swept off toward the south, gradually disappearing. Just south and east of the crossing of the streamer with the Milky Way were ten or twelve lines of light, and at right angles with the streamer, but separated 3° or 4° from it, and nearly parallel to each other. These bands were 5° or 6° in length. During this time there were faint northern lights streaming up at right angles to the band.

By some it was thought that a nebulous belt had touched the earth's atmosphere. Had such a contact occurred in the daytime, penetrating the atmosphere more deeply, the effect might have been like that of the 6th.

During the auroral display, and for some hours after, the Atlantic cables were greatly obstructed by a magnetic storm, and the land lines also as far west as Chicago. The storm neutralized the force of the batteries, but the atmospheric currents of electricity were not strong enough to telegraph with, as was the case during the memorable electric storm of October, 1872.

THE TEMPERATURE OF MAMMOTH CAVE.

BY H. C. HOVEY.

It is estimated that twelve million cubic yards of limestone have been displaced by the great excavation known as Mammoth Cave. The importance of ascertaining exactly the temperature of the volume of air and bodies of water found in such a locality appears on considering the fact that it would coincide with the temperature of the earth's crust in the region where it is located.

The task has its difficulties. The darkness of the cavern makes it necessary, of course, to make the observations by lamplight, and the proximity of the flame renders the mercury liable to expand by an increase of heat. The warmth of the hand may also be imparted to it in carrying the instrument along; and a sensible impression is made even by persons standing with their lamps at a distance of several feet. Add the fact that all thermometers increase their readings with age, and an explanation is found of the errors into which observers have sometimes fallen, and which I have tried to avoid in the experiments now recorded. The result of such errors is an oft-quoted statement that the uniform temperature of the above cavern and the region around it is 59° Fah. at all seasons of the year. I shall show this to be too high by about 6°.

My first set of observations were made in August, 1878, with what was regarded as a good thermometer of German make. The table of readings, though not on the whole satisfactory, may be of some value for comparison, and are given below:

At the hotel on the hill the mercury stood, at noon on the 19th of August, 1878, at.	102	deg. Fah.
At the entrance to the cave	66	" "
In the Rotunda (1,000 yards within)	58	" "
In River Hall (a mile and a half within)	57	" "
At the Bottomless Pit, Mary's Vineyard, Marion's Avenue, and various other points, including the waters of the Dead Sea, Lake Lethe, and Echo River	56	" "
In El-Ghor, Washington Hall, and Rhoda's Arcade,	55	" "
In Lucy's Dome	54	" "
In the waters of Helen's Spring, Hebe's Spring, and in the Cascade of the River Styx.	53	" "
In the water of Richardson's Spring	52	" "

According to this table the temperature varies from 52° to 58° in the cave, the average being 56° Fah.

But this, although 3° lower than the previous observations of local physicists would justify, proved on comparison with Yale standards to be still too high by two or three degrees; and I therefore determined to make a new set of experiments of such a nature as should insure perfect accuracy.

A common, but fairly reliable thermometer was fixed at a point 1,000 yards within the cave, where it was allowed to remain for six months undisturbed. This gave it time to adapt itself to its surroundings, and gave the manager of the cave, Mr. Francis Klett, an opportunity to take daily observations during the transition from winter to summer, and in all sorts of weather. His report to me was summed up in the statement that after being, so to speak, acclimated, this thermometer did not vary more that 1° for months together, and indicated a uniform temperature of from 53° to 54° Fah. This was as I had anticipated. But my object being to ascertain the temperature of a large area it would not do to base a conclusion on the testimony of a single witness, and that an instrument remaining constantly in one place.

Accordingly, on revisiting Mammoth Cave, last August, I armed myself with two of the best mercurial thermometers belonging to the Winchester Observatory of New Haven, kindly lent to me by Prof. Waldo, the astronomer in charge, and which are described as follows:

(No. 1.) Casella, London, K. O. 10,662. The gradation allowed one-fifteenth of an inch to a degree, ranging from +10° to +120° Fah., marked both on the glass tube and on a porcelain slide, and determined by comparison with Yale standards to be accurate within two-tenths of a degree. Mounted in a copper frame with a large ring attached, by which it could be swung, in order more quickly to bring the temperature down to that of the air, the tube and slide being also detachable from the frame for convenience in immersion in water.

(No. 2.) J. & J. H. Green, New York, 1879. No. 4,509. Space allowed to one degree, one-eighteenth of an inch. Graduated from — 30° to + 120° Fah., marked on glass tube and metallic scale, and carried by a brass holder. This instrument, having been "seasoned" at the Winchester Observatory, was said to be accurate to within one-tenth of one degree.

With these practically perfect instruments I took the temperature, first, of White's Cave, about a mile distant from the mouth of Mammoth Cave, with which it is supposed to have a point of connection. Here the following results were obtained:

At the mouth of White's Cave, August 12, 1881, the mercury indicated, in the shade	86	deg. Fah.
Just within the entrance	80	" "
At the Naiad's Bath (in the water)	53	" "
" " " " (in the air)	54	" "
At the end of the cave	54	" "

The entire length of White's Cave being but a quarter of a mile, the rapid fall of the mercury from 86° at the mouth to 54° at the end confirms the opinion, formed on other grounds, that it has a secret connection with the far larger cavern adjacent.

The difference of one degree between the water of the basin and the air above it is not due to evaporation—care being taken in this and similar cases to avoid this cause of error. It is probable that the temperature of the water is that of the surrounding earth, while that of the air is modified by external influences.

The following observations were made on the 13th and 15th days of August, 1881, in Mammoth Cave:

At the hotel on the hill the mercury indicated	92	deg. Fah.
At the mouth of the cave (at noon)	65½	" "
" " " " " (at 7 P.M)	60	" "
At the Iron Gate, 100 yards within, where the current is strongest	52½	" "
In the Rotunda (1,000 yards within)	53	" "
In Audubon's Avenue	54	" "
In Little Bat Avenue	54	" "
In the Gothic Avenue (oldest and driest portion)	56	" "
In Richardson's Spring (in the water)	54	" "
In the Arched Way	54½	" "
At the Bottomless Pit (top)	54	" "
" " " " (midway)	56	" "
" " " " (at the bottom)	53	" "
In the Mammoth Dome (top, 250 feet above bottom)	54	" "
" " " " (midway)	53½	" "
" " " " (bottom)	53	" "
At the Echo River (in the water)	55	" "
" " " " (in the air)	56	" "
" " " " (where it empties into Green River)	58	" "

From this second table of observations it will be seen that the temperature is more uniform throughout the cave than appeared from the notes taken in 1878. The variations occurring are due to actual differences caused by the sinking of cold air to the lowest places. The single exception to this is found at Echo River, which is known to be 328 feet below the surface, and yet has as high a temperature as any other locality in the cave. This may be explained by reason of its connection with the outer pools known as the Upper and Lower Big Springs, and lying beneath the high bluffs of Green River.

The fact that the temperature of the Bottomless Pit at a point midway is higher than at either the top or bottom, may be accounted for by reason of an avenue here setting in that was anciently the path of drainage into River Hall, where the mercury stood at 56°.

It should be stated that the greatest pains was taken to keep the bulb and stem of the instruments dry, except, of course, in observations of the water, which, however, were always taken after those taken in the air, so that results need not be modified by the evaporation of moisture. As a rule, the thermometer was, in each instance, left for half an hour where it could not be influenced by animal heat or that of any lamp, and when the degree was read it was done as quickly as possible, before there was any perceptible rise of the mercury.

By these observations I claim that those made previously and with less accuracy ought to be superseded, and that the following facts are definitely settled, namely:

1. That the highest temperature found in any part of Mammoth Cave, during the hottest season known in Kentucky for many years, does not exceed 56° Fah., and that may, therefore, be regarded as the *maximum.*

2. The lowest temperature found in any portion of the cave during the six months from March to September, 1881, was that indicated at the Iron Gate, namely 52½° Fah., and that may be regarded as the *minimum.* (It is admitted, however, that the very strong air current at this point may have slightly lowered the mercury by causing the evaporation of unobserved moisture from the surface of the tube.)

3. Reviewing all my observations, made in numerous widely separated localities, I find the *mean* temperature of Mammoth Cave in midsummer to be 54° Fah.

4. I regard the temperature indicated on the floor of the Rotunda, and at the bottom of the Mammoth Dome and of the Bottomless Pit, namely, 53° Fah., as the best indication of the true temperature of the earth's crust in the vicinity of Mammoth Cave; and presumably so for the belt lying along the 37th parallel of latitude, near which that cave is located.

More Comets.

E. E. Barnard, of Nashville, Tennessee, discovered at his observatory, at 2 A.M., September 19, a bright telescopic comet in 7 hours 46 minutes right ascension and 13 degrees 28 minutes north declination, with a daily motion of three degrees northeast. Its position is described as near Zeta Virginis. No tail was apparent. The observation was confirmed the next day.

Director Swift, of the Warner Observatory, Rochester, N. Y., announces the discovery by him, at 1 A.M., September 20, of the expected Encke's comet, near Beta Aurigæ.

Four comets are now visible with a good telescope—B, C, D, and Encke's.

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MECHANICAL INVENTIONS.

An improved horse power mechanism has been patented by Mr. William McE. Dye, of New York city. The object of this invention is to furnish an improved horse power mechanism for various industrial operations usually performed by steam, water, or wind power. This invention is an improvement in that class of power mechanism which combines a continuously acting lever and an endless inclined plane, formed practically of a circular disk pivoted at its center on a ball-and-socket or other universal joint, upon which joint the disk is made to oscillate by the weight of a draught animal moving in a regular manner around its perimeter and up the inclined plane.

Mr. Adam Breth, of New Washington, Pa., has patented a new and improved device for cutting or clipping bolts. The invention consists in pivoting the movable jaw of bolt clippers to a bl ock made adjustable by a clamp screw passing through slots of spring and jaw.

An improved wagon has been patented by Mr. Fredrick Borntrager, of St. Clair, Mich. This invention relates to that class of wagons which have jointed reaches for enabling the wagon to be turned within a small compass.

Messrs. Charles E. Mayo and William L. Perry, of Lowell, Mass., have patented an improved foot power machine for driving saws, lathes, and performing work of similar character requiring small power and high speed. The invention consists in a clutch pulley of novel construction and a treadle arranged to act always in one direction, these parts being combined to secure continuous motion of the driven shaft.

An improved ice cutting machine, patented by Mr. James Shannon, of Cohoes, N. Y., consists of a sled-shaped frame supporting vertical side standards, on which are pivoted forward projecting arms, that are adjustable in a vertical plane by eccentrics and levers, and carry on their free ends vertically-revolving circular saws for cutting the ice, which saws are operated by suitable belts and pulleys on gearing that form part of the device; and it consists, further, of a series of revolving toothed wheels keyed on a horizontal cross shaft in the rear portion of the device, which wheels are designed to rest upon the ice and to urge the machine forward by their revolutions. The saw carrying arms and the rear portion of the machine are also provided with platforms for the operators to stand upon or for the reception of weights to force the saws and toothed wheels into the ice for their more efficient work.

IMPROVED STEAM ENGINE PISTON.

The engravings illustrate the improvements patented by Henry Waterman, of Brooklyn, N. Y., July 12, 1881, and relate to metallic pistons. The object of the invention is to render the piston tight and prevent loss of power by passage of steam into and through the piston; also to compensate for wear and render the packing and its parts easily adjustable. The invention will commend itself to engineers as being very practical in all its details, easily made, durable, and readily adjustable.

In the accompanying drawings, Fig. 1 is a plan view of the piston, with the face plate and packing disk removed. Fig. 2 is a transverse section of the piston; and Fig. 3 a section of the convex spring packing plate.

A is the hub, formed with the face plate, *a*, and with radial arms, *b*, to which the face plate, *c*, is secured by screws, *d*. B B are split rings placed upon a wide inner split ring, C, between the plates, *a c*. The ring, C, is backed at three equidistant points by spring plates, *e*, and keys, *f*, and at the side opposite its open ends by a curved block or plate, *g*, and key or keys, *h*. The arms, *b*, of the hub are recessed at their outer ends to form lugs, *i*, between which the keys, *f h*, enter. The plates, *e*, at each point are two or more in number, so as to form leaf springs, and are secured by a rivet or otherwise to the keys. The block, *g*, is formed with a central hemispherical socket, *k*, in its inner face, and the key, *h*, is formed with a hemispherical stud, *l*, which enters the socket, *k*, the stud thus preventing lateral movement of block, *g*, while permitting it to rock. The outer convex surface of block, *g*, is formed with a transverse groove, *m*, that is engaged by a stud, *n*, projecting from ring, C. By this construction the ring, block, and key are retained in their proper relative positions, and the block may adjust itself accurately to the inner surface of the ring.

In the recesses of the arms, *b*, behind the keys, *f h*, are filling plates or strips, *o*, of any desired number, as required to expand the ring, C. These being placed to fill out the space when the piston is set or from time to time, as required, furnish solid resistance, and unequal wear can be accurately compensated for.

It will be seen that the expansible ring, C, is held rigidly at its middle portion between the ends, while the remaining portion is allowed a limited amount of movement by the leaf springs, *e*.

Between the plate, *c*, and the edges of rings, B C, is the packing, *p*. This may consist of a circular plate of spring metal, of convex concave form, as shown in Fig. 3, which being clamped by plate, *c*, packs the joints between the plate and rings, so as to exclude steam from the interior of the piston.

For large size pistons I prefer to use packing rings or ring segments. These will be made of spring metal and curved transversely, so that when placed upon the expansible rings and clamped down by the face plate they insure a tight joint.

This piston, when fitted with plate, *g*, is especially adapted for use in horizontal cylinders, where, on account of the sag, the wear on the packing rings, B, is unequal. Such wear can be readily compensated for by adjustment of the backing without affecting the solidity of parts.

Fig. 1.

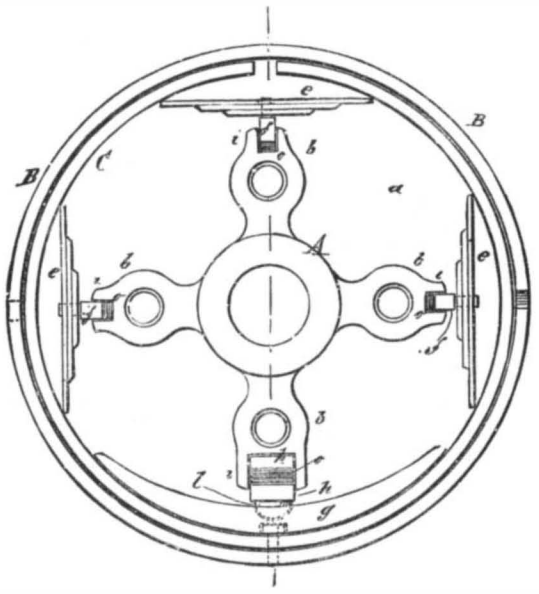


Fig. 2.

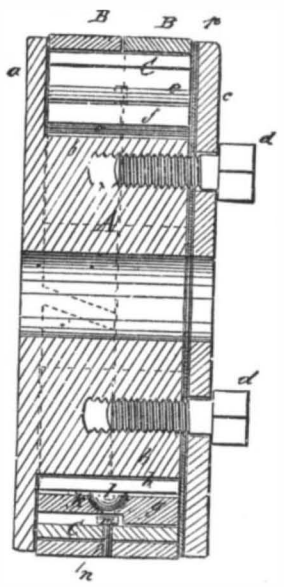


Fig. 3.

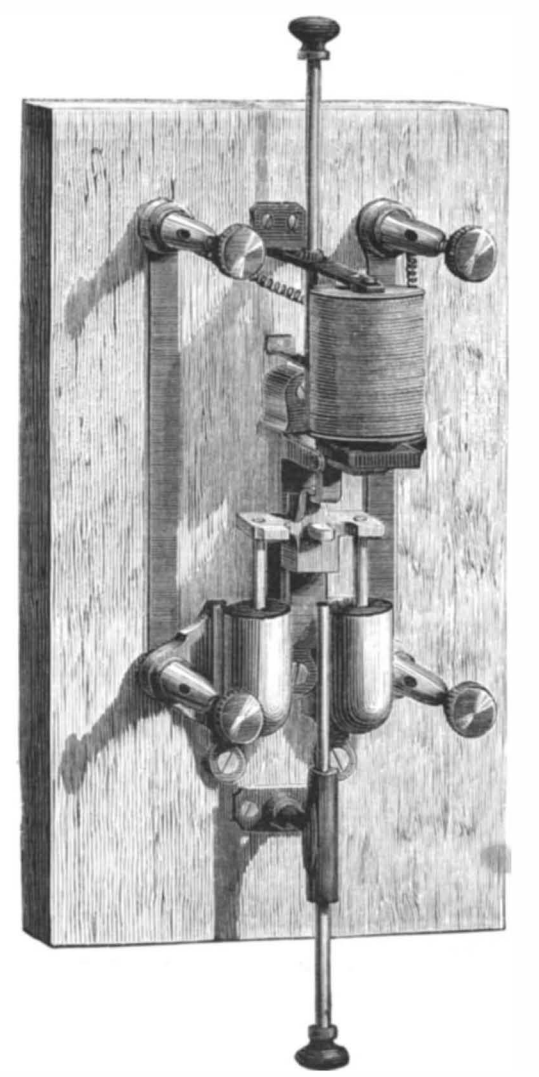
WATERMAN'S IMPROVED PISTON.

For use in vertical cylinders the plate, *g*, is not essential

Further information can be obtained by addressing the patentee, Henry Waterman, 18 Dunham Place, Brooklyn, N. Y.

CUT-OFF FOR ELECTRIC LAMPS.

The present tendency in voltaic arc systems is to place several lamps in the same circuit, their number varying from three or four up to *forty*. The great advantage of such an arrangement exists, as well known, in the great saving in wire that results from it. But, as an offset, it is necessary to employ currents of very high tension, and if this be too great the apparatus may become dangerous; and then, too, the insulation of the wire is very difficult.



RAPIEFF'S CUT-OFF FOR ELECTRIC LAMPS.

In practice it is well not to attain so exaggerated tensions, but to be content with placing only ten, twelve, or sixteen lamps, at the most, in the same circuit. But under these conditions all the lamps are mutually independent, and if one of them, through some accidental cause, is extinguished all the rest go out at the same time. This is a very grave trouble, for which various remedies have been sought. It was for the purpose of obviating it that Mr. Rapieff devised his "safety apparatus," and that all the Brush lamps are furnished with an arrangement called a "cut-off." Mr. Anatole Gérard's "automatic sentinel," which we are about to describe, accomplishes the same object with at least as great a simplicity and with one additional advantage—it is completely independent of the lamp; it forms an apparatus apart, easy to watch, and always within reach of the hand whenever it is desired to make several lamps in the same circuit independent of one another; and it is applicable to all lamps in service, whether they are continuous current or alternating current, voltaic arc or incandescent.

The accompanying cut will allow the working of the apparatus to be readily understood. It consists of a straight, fine wire and single-bobbin magnet, the extremities of whose wires are connected with the two upper terminals, to which, also, are joined the two wires coming from the lamp to which the apparatus is adapted. The conductor coming from the machine is connected with the lower terminal to the left, and the wire proceeding from the lower terminal to the right goes to the second lamp and second apparatus.

The two lower terminals are in metallic communication with two small iron cups which are half full of mercury. Above these cups there are two iron rods fixed to a metal cross-piece carrying a hook which engages with a second hook fixed to the armature of the electro-magnet. When the current passes it divides itself between the lamp and the fine wire of the electro-magnet without the armature being attracted thereby. In case of an accident or the extinction of a lamp, the entire current passes through the fine wire, and, the electro-magnet becoming active, attracts its armature, which, on tilting, disengages the hook and allows the two rods to drop into the cups of mercury.

The current then passes directly from one lower terminal to the second, that is to say, from one lamp to the other, through the intermedium of the iron rods; and thus the circuit is not interrupted by the accident which happened to one particular lamp, and all the others continue to operate just as if nothing unusual had occurred.

As may be conceived, it would be easy, instead of establishing a *direct* communication, to intercalate a resistance equivalent to that of the lamp put out of service, so as not to disturb the conditions of the electric circulation; and it would be easy likewise to utilize the fall of the rods for actuating an alarm bell, or even an indicating tablet, and thus to convert the apparatus into an automatic tell-tale, which would not be without utility in certain kinds of night work.

This apparatus also replaces the ordinary commutator; since, in order to relight a lamp when extinguished it is only necessary to press on the button located beneath. On raising the rod it strikes against a spur projecting from the cross-piece which supports the two rods, and, lifting it, causes the two hooks to engage, and the current then passes through the lamp. To extinguish a lamp it is only necessary to press upon the upper button, when the rod to which it is attached tilts the armature, disengages the hooks, and closes the circuit anew by the dropping of the iron rods into the mercury cups.

In a more recent model than the one here represented Mr. Gérard has arranged the mercury cups one above the other, instead of placing them side by side. The present arrangement gives greater width to the apparatus, which often has to be located on a narrow support, but the principle is in no wise changed thereby.—*L'Electricien.*

A Wrong to be Righted.

The schooner M. C. Mosley, of Boston, on the way to Charleston, picked up at sea the captain and crew of the brig Alphonse, which had been disabled in a recent storm and abandoned. At Charleston the health authorities learned that the shipwrecked mariners were from the infected port of Cienfuegos, and properly ordered the Mosley to quarantine. The chance of yellow fever infection from shipwrecked sailors, who had endured twenty-four hours of severe exposure to storm in open boats, was certainly slight; but the law was specific, and the health officers were constrained to obey it.

It does not seem right, however, that the performance of a meritorious act on the part of the captain of the Mosley should meet with no other recompense than the inconvenience and losses incident to quarantine. That would be very like imposing a penalty for doing an act of humanity. The case would seem to be a suitable one for special action on the part of the national government, to recognize and reward appropriately the conduct of the captain and crew of the Mosley, and to repay the owner of the vessel for the loss occasioned by the delay in quarantine. The case is not likely to be often repeated; still, it would be a misfortune to have an evil precedent established by means of it.

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Fire Engineers' Convention.

The ninth annual convention of the National Association of Fire Engineers assembled in Richmond, Va., September 13, President Green, of Boston, in the chair. The officers elected for the ensuing year were: President—G. Watt Taylor, of Richmond. Vice-Presidents—One from each State. Secretary—Harry Hill, of Cincinnati. Treasurer—A. C. S. Hendrick, of New Haven, Conn.

LIME-EXTRACTING HEATER AND FILTER.

Where the feed water is pumped directly into the boiler without being purified, the heat soon frees the impurities, which are precipitated upon the inner surfaces of the boiler shell and upon the flues, to which they cling in the form of scale, which is a non-conductor of heat, and being interposed between the water and the boiler shell, allowing the fire to act injuriously on the iron, rapidly deteriorating it, soon weakening the boiler, and incurring the dangers of explosion and the expense of frequent repairs. Stoppages and delays in cleaning boilers, as well as priming or foaming, which carries grit over into the engine to its great injury, must be reckoned among evils resulting from impure feed water.

The actual cost and damages sustained from these more prominent evils, together with many minor ones unmentioned, all of which directly and inevitably result from the presence of scale in boilers, if summed up and expressed in dollars would greatly astonish steam users.

Much thought, time, and money have been expended in experimenting with reference to the nature and effects of boiler incrustations. In an able paper on "Incrustation of Steam Boilers," read before the American Association for the Advancement of Science by Dr. Joseph G. Rogers, he says: "The evil effects of scale are due to the fact that it is relatively a non-conductor of heat. Its conducting power as compared to that of iron is as 1 to $\frac{2}{50}$. This known, it is readily appreciated that more fuel is required to heat water through scale and iron than through iron alone. It has been demonstrated that a scale of one-sixteenth of an inch thick requires the extra expenditure of fifteen per cent more fuel. As the scale thickens the ratio increases; thus, when it is one-fourth of an inch thick, sixty per cent more is required; at one-half of an inch, one hundred and fifty per cent, and so on. To raise steam to a working pressure of ninety pounds the water must be heated to 320° Fah. This may be done through a one-fourth inch iron shell by heating the external surface to about 325°. If a one-half inch scale intervenes the boiler must be heated to 700°, almost a low red heat. The higher the temperature at which iron is kept the more rapidly it oxidizes, and at any temperature above 600° it soon becomes granular and brittle from carbonization or conversion into the state of cast iron. Weakness of boilers thus produced predisposes to sudden explosions, and makes expensive repairs necessary."

Ordinarily there will have accumulated in a new boiler after four months' use one-sixteenth of an inch of scale; after eight months' use, one eighth of an inch of scale, and so on. Now, if Dr. Rogers' theory is correct, it necessarily follows that after one month's service a boiler will consume three and one-fourth per cent more fuel than at first; after two months' service, seven and one-half per cent more, and so on, making an average for the year of over twenty per cent more fuel than it would have consumed if using pure water.

The difficulty of this scale formation can be overcome in three different ways:

First.—Picking the scale off by mechanical means.

Second.—Purging the boiler by means of the chemical compounds known as boiler powders. This is dangerous, chiefly from the fact that an acid or other chemical strong enough to eat off the scale will not stop there, but will go ahead and eat the boiler shell as well.

Third.—The use of pure water. The simplest and surest way is always the safest and best. If the water is purified from scale forming material before entering the boiler, certainly no scale can form.

This brings us directly to a consideration of the means acknowledged by competent engineers as the best in use for the prevention of this formation by the furnishing of pure water, and this is exactly what the Stilwell heater accomplishes. The water enters the heater at the top, and in its downward passage traverses a large area of heating and depositing surfaces, arranged in the form of removable shelves, having alternate openings. As the thin sheet of water passes over these shelves, all of which are very hot, and descends from shelf to shelf, it is met in its downward course and constantly acted upon by an ascending current of steam which enters the heater at the lower port. The action of this lower current of steam completes the separation and precipitation of the foreign particles which is begun when the water enters the heater. The construction of the heater is such that not a drop of water can pass down through it without being thoroughly boiled. The lime, magnesia, sulphur, iron, silica, etc., which this process of boiling sets free from the water, are deposited in a crystallized state upon the entire series of shelves, the deposit always being heaviest upon the upper shelf and diminishing in quantity as it approaches the lower shelf. From this lower shelf the water passes through the filtering chamber, which completes the purification, and it is then fit to enter the boiler.

In this heater the escape steam from the engine is utilized, and the volume used enables the purifying of large quantities of water, while every particle of the water is boiled thoroughly.

The arrangement of the shelves and the ease with which they can be handled and withdrawn for cleansing.

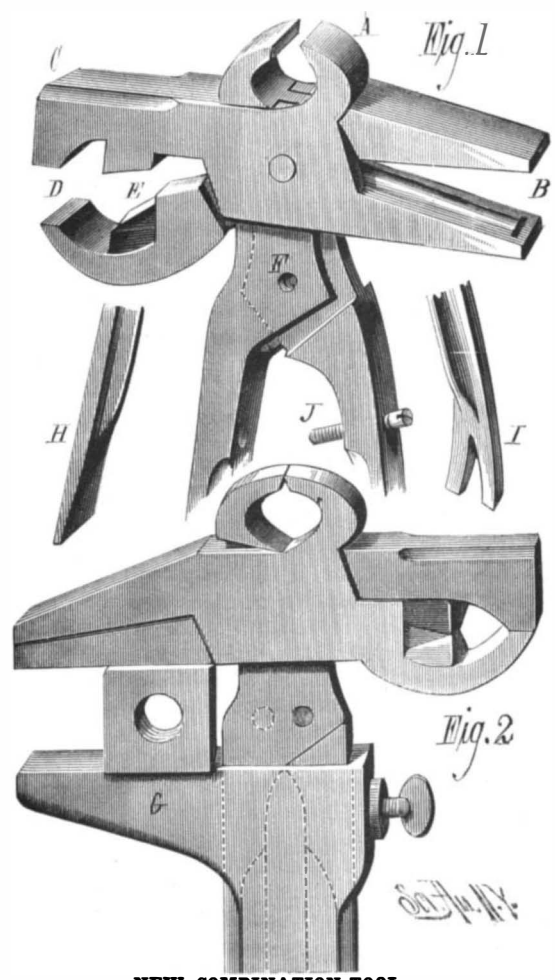
The filtering system, the leading point in which is that the water passes upward through the filtering chamber on its way to the discharge pipe and not downward or sideways, as is usually the case.

STILWELL'S LIME-EXTRACTING HEATER AND FILTER.

These heaters have been tested abundantly during the past ten years, and we are informed that there are to-day over three thousand in active use. They are manufactured by the Stilwell & Bierce Manufacturing Company, of Dayton, Ohio.

IMPROVED COMBINATION TOOL.

The engraving shows a new implement combining many useful tools in a compact and handy form. It forms a pair



NEW COMBINATION TOOL.

of nippers, A, a pair of pliers, B, which are provided with a rib in one jaw and a corresponding groove in the other jaw for the purpose of crimping the ends of stove pipe to facilitate putting the lengths together.

The end opposite the pliers is formed into a hammer head, C, against the under side of which the jaw, D, closes. This jaw and the adjacent surface of the hammer head are recessed, forming a holder for the nail, enabling the user to start and drive a nail with one hand.

The two halves of the tool are perforated at F, at the joint, to form a wire cutter, and an adjustable jaw, G, is fitted to the handles, forming a monkey-wrench.

A screw, J, in one of the handles, and a corresponding hole in the opposite handle, forms a punch and die for making holes in metal.

The end of one of the handles forms a tack puller, and the end of the other a screwdriver.

Fig. 1 shows the head of the implement and the end of the handles.

Fig. 2 shows the implement with the wrench jaw attached.

This invention was lately patented by Mr. John Straszer, of Manchester, Mo.

Eruption of Mount Lapwai, Idaho.

The recent report of a volcanic eruption in Idaho Territory is confirmed by a correspondent of the *Eagle*, of Butler, Pa., who visited the volcano about the middle of August in company with a representative of a Walla Walla newspaper.

As seen from Camas Prairie the column of smoke rising from Mount Lapwai was like that of a steamer beyond the horizon at sea. The mountain is two days' ride from Camas Prairie. Omitting unimportant personal details, the correspondent's account runs as follows:

"About 500 feet below the cone a large column of smoke sprang into the air hundreds of feet and then folded over to the east. Flames shot up to a great height, and a seething flow of lava was at that time rushing down into a small valley to the west and emitting a strong, sickening sulphuric odor, which made it impossible to remain by it any length of time. The lava had moved a distance of one mile from the mountain and was gradually making its way toward the Salmon. The neighboring hills were covered with ashes."

The visitors were informed by a Lapwai Indian that the lava flow is intermittent. With the wind at their backs they climbed the cone when the crater was quiet, though greatly disturbed and sickened by the sulphurous odors. The crater was about 500 feet below the rim of the cone, and appeared to be about an acre in extent. When the flow ceased the visitors went down to the edge of the crater, after covering their faces with rubber folds and their eyes with glasses. The heat was great. On one side it was possible to descend twenty feet into the crater without being nauseated, thanks to a favorable wind. The lava poured into the crater from the sides, and, when it was full, bubbled over and ran into the valley. The surrounding country is volcanic, and the Indians reported a recent eruption of Mount Idaho, a large peak a few miles from Mount Lapwai.

The visitors spent twenty minutes in the crater. At 5:45 P.M. the flow began again, and they hastily retreated. Scientific parties were fitting out at Portland, Oregon, toward the end of August, to visit the volcano. Mount Lapwai is one of the Blue Mountains, a low range crossed by the Snake River.

New Steamer for Oregon.

The new iron steamship, Walla Walla, the seventh vessel built by John Roach & Sons for the Oregon Navigation and Improvement Company, is now taking in cars and railroad material for the company, preparatory to her voyage to Oregon. The Walla Walla is 336 feet in length, 40½ feet beam, 23½ feet depth of hold, and of 5,000 tons displacement when loaded. She is constructed wholly of iron, with seven watertight compartments, with one complete iron deck, and the second deck is three-fourths iron. As she is constructed for the purpose of carrying coal between Seattle, Puget Sound, and San Francisco, and will probably return without cargo, she is fitted with three water-ballast tanks to retain the center of gravity on line with the keel, when the vessel is discharged of cargo. All the deck houses are built of iron, and a handsomely furnished cabin and staterooms aft afford accommodations for thirty first-class passengers. The vessel is fitted with compound engines of 2,000 estimated horse power, and has six cylindrical boilers, and her estimated speed when fully laden is twelve knots an hour. She is schooner rigged, with a square sail forward, and upon her arrival at San Francisco will take her place on the regular route with the two other colliers recently built—the Willamette and the Umatilla.

Battery Carbon.

A useful method of preparing cheap carbon poles for voltaic batteries has been devised by M. Mauri. It consists in taking finely powdered graphite mixed with an equal weight of sulphur free from carbonate, and heating the mixture in a crucible until all the sulphur is fused. The temperature, however, should not be raised over 200° Cent. When the mass is fluid it is poured into a suitable mould of metal, and a stout copper wire is inserted to serve for an electrode. When the mass is cool and solid it is ready for use. Its conductivity is practically as good as that of the best retort carbon, and as it is more electro-negative than simple carbon, the electromotive force of the cell is higher. By increasing the proportion of sulphur in the mixture a highly resisting composition may be obtained which can take the place of copper or platinum silver coils for telegraphic or electric lighting purposes.

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AMERICAN INDUSTRIES.—No. 76.

MACHINERY IN THE BOOT AND SHOE MANUFACTURE, AT THE FAIR OF THE MANUFACTURERS AND MECHANICS' INSTITUTE, BOSTON.

Never before has there been so good an opportunity for the public to become familiar with the modern processes of boot and shoe making as is presented in the "Model Shoe Factory" of Messrs. Houghton, Coolidge & Co., now running in the Fair of the New England Manufacturers and Mechanics' Institute at Boston. About 100 hands are employed, making an average of 600 pairs of boots a day, and doing the work thereon in the same way as the business is followed in half a hundred towns in Massachusetts, with all the modern appliances for facilitating production and making the best finished goods in complete and regular operation. There have been other exhibitions in which portions of the work have been shown, and much of the machinery now employed in the boot and shoe manufacture has been in use many years, but here a visitor can see every detail of the work, from the leather as it arrives from the tanneries and currying shops until the finished goods are boxed up in the cases which are to convey them from the exhibition building to distant parts of our own country, or even to foreign ports. We have, it is true, but a small export trade in boots and shoes, but this exhibition has been an object of great interest to many foreign visitors interested in the trade, as well as to our own manufacturers, and some orders for goods for export direct have been placed by foreigners who have been there looking into our processes of manufacture.

The illustrations on our first page give a good representation of this "Model Shoe Factory" and the building in which the exhibition is held, as well as of some of the most important machinery used. The building is a solid structure of iron and brick, and occupies a ground space of 403 by 551 feet, the shoe factory taking up an area of about 50 by 450 feet, and in this section are to be found nearly 100 machines, large and small, operated by over 300 feet of shafting. But it is curious to note that, with the vivid portrayal of the methods of modern manufacture here brought before the eye, the crowds constantly passing and repassing seem nowhere to find so great an attraction as in watching the work of the venerable looking shoemaker, who, occupying an old shoemaker's bench on which he has followed his trade for fifty-six years, continues here to represent, in the midst of such surroundings, the difference between "the old and the new."

The cutting of the sole stock, as in most modern factories, is here done with dies, and the fitting up of a large factory with the different sizes and shapes of dies required forms no inconsiderable item of expense, leading the manufacturer to strenuously oppose any change of fashion which will necessitate the making of a differently shaped sole. In many cases the sole leather is first cut into strips, the width of which equals the length of a sole, but the later and more approved plan is to cut directly from the whole side, as here shown. The whole side is laid out upon a large table, the top of which is level with the bed of a machine long enough to take in its entire length, so that the workman can place the die on any portion of the side, and then, by a treadle movement, instantaneously bring down a bar with sufficient force to cut out the sole. This may be done as rapidly as the operator can place the die, but good judgment is required in selecting the most thick and solid parts of the leather for outsoles, the thinner and poorer portions being used for insoles and heels. Smaller machines of the same style are used for cutting out the taps, counters, and heel lifts, as these are cut from the parts of the side left after all the outsoles possible have been cut therefrom, the idea in each instance being to so place the dies on the stock as to avoid waste.

The cutting of the uppers is all done by hand, the sides of upper and calfskins being laid out where the cutter can have good opportunity to examine the leather in every part before placing his patterns thereon, in order not only to cut up the stock with the least waste, but to be sure and have good strong leather on the vamp and forepart of the boot, the poorer portions being used for the backs.

In order, however, to give the leather such shape that it may be brought to fit the last snugly, and not partially straighten out or lose its form at any time afterward, the uppers must be broken or crimped. To do this work well was always a laborious and tedious operation, until, about ten years ago, the S. W. Jamison crimping machine was introduced. A view of these machines is shown at the top of the page. By their use the vamp of a boot of the heaviest cow-hide leather can be forced into the desired shape for lasting almost instantaneously, the stretch of the leather required in this forming being so evenly distributed that the strength of the stock is not impaired and the leather will hold permanently its new form. The machine is a powerful but not very complicated one, a former, worked by a lever, forcing the upper into suitably shaped jaws, which close upon and smooth it into the desired shape. These machines have so fully met the requirements of the trade that they have become deservedly popular and been widely introduced, as it had hardly been possible, before this machine was brought out, to thoroughly crimp the leather used in heavy boots and brogans so that they would steadily retain their shape after repeated wettings.

For the putting together of the uppers of boots and shoes two distinct styles of machines are used, one using waxed thread for heavy leathers, and for stock in general which has oil or stuffing in it, and the other using dry thread for goat and kid and sheepskin work, for fancy stitching generally, and for putting in linings, working button holes, etc. The goods made in the "Model Shoe Factory" being a standard grade of heavy work, wax thread machines only are used here, two, with steam-heated wax cups, being used for siding-up boot legs, two for sewing in the heavy sole leather counters which give a proper stiffness to the heel, two for making stays over the seams on the inside of the leg at the ankle, and another stitching on the straps at the top. Besides the machines here shown doing this work, there are others shown in the Fair for similar use, and for sewing on heavy harness and belting.

The uppers having been put together, and the soles, slightly dampened, having been pressed into shape by a "beating out" or sole moulding machine, the next operation is the "lasting," or the drawing of the upper snugly and evenly over the last, so that it will fit closely in all parts, and the edges just lap over the outer edge of the insole, all temporarily fastened until the outsole can be attached. This is commonly done by hand, the workmen drawing the leather over with pincers and tacking it in place. To do this work by machine has been a task the solution of which has been sought by mechanics and inventors for many years, but no machine for the purpose has yet been introduced which has met with any considerable degree of favor from manufacturers. There is a lasting machine at work here upon which years of labor and experiment have been expended, and it appears to do its work fairly well, but it can hardly be said to have passed beyond the experimental stage as yet, and has been adopted by the trade to only a limited extent.

For the putting on of the soles, four different methods are shown—one by a machine sewing directly through from the inside to the outside (this being under the well-known Blake-McKay patents), one by pegging, and another by wire screwing, and the fourth by what is known as the Goodyear and McKay system. Of the machinery for the latter we give illustrations on the first page, in connection with which will also be found views showing the appearance of the stitch on a finished shoe, a cross section of insole prepared for stitching, and bottom with welt attached. The boots and shoes made by this process differ from all other machine-made work, and are a direct imitation of hand-made goods. The shoe is lasted as for hand sewing, except that the insole is channeled, and then a machine working with a curved needle and awl in a small circle sews on a welt, in the same way as it would be done by hand, after which another machine sews the outsole to the welt. The only difference that can be detected between a boot or shoe made on these machines and one made by hand, is that in the latter the stitches are not likely to be as regular and even as they are in the machine-made work.

Of course, boots and shoes made in this way have no nails or threads on the inside to hurt the foot, they can be readily repaired the same as a hand-made shoe, and they have all the advantages of flexibility with a proper firmness of sole, which is always found in welted shoes. The machines for making this work have been perfected only by the expenditure of many years' labor and a great amount of money, but Mr. Charles Goodyear, their inventor, whose father gave to the world its great India-rubber industry, would never stop short of the realization of the idea with which he started out, of making boots and shoes by machine which would be in every respect equal to the best of those made by hand. That he has succeeded is now being abundantly attested, not only by the samples of work shown, but by the increasing demand for the machines in shoe factories, and for the goods made thereon from buyers in all sections of the country.

Besides the machines for making welted goods, the Goodyear and McKay exhibit also shows their machines for making "turns," a technical name in the trade to denote shoes which are made inside out, and then "turned." This of necessity can only be done in work where both the sole and upper stock are light, but there is a heavy trade in such goods, a very large proportion of which is made on these machines.

Among the machinery required in a modern boot and shoe factory, that for making and putting on heels occupies an important place, and the work in this department is an object of never-ceasing interest to the visitors at the Fair. It is represented in one of the views at the top of the page, and consists of a combination of machinery covering the forming, attaching, and trimming of heels, by what are known as the McKay, Bigelow, and Fisher machines.

The Bigelow machine takes a heel, the lifts or layers of which have been assembled and tacked together, consolidates and shapes it under enormous pressure, punches it with nail-holes, and inserts and partially drives the nails. The McKay machine receives a heelless shoe and the heel thus prepared, and instantly nails and clinches them together, at the same time paring the heel to the required shape.

The Fisher machine, now on exhibition for the first time, we have given the most prominent position at the right of our cut on account of its novelty. It is a modified and improved form of the Bigelow machine, the substantial difference being found in the construction and operation of the mould which compresses and forms the heel. In the Bigelow machine, the mould is made in one piece and is adapted only to certain shapes of heel, while in the Fisher machine the mould is made in halves, which first approach each other and compress the heel laterally, then vertically, and finally punch it with nail-holes, all at a single descent of the plunger; thus closing every joint in the heel, which, upon this machine, may be made of any shape whatever. This machine is the simpler and less expensive, as well as applicable to a wider range of styles.

After the bottoms and the heels have been attached and trimmed, there is quite a variety of machines for trimming and shaping the edges, for buffing the bottom, and for burnishing the edges of the sole, shank, and heel, in all of which operations the work is greatly expedited and generally better done than it would be possible ordinarily to do it by hand. But one of the last operations is the treeing, which has much to do with the making of a nice looking boot, for the leather, which has been repeatedly wet and constantly handled through so many operations, must be again made to look its best, with all the seams smoothed down, and the shape of the boot effectively brought out.

For this purpose a machine is here used which is quite new in the trade, a representation of which is given in one of the separate views on the first page, while it can also be readily seen in the foreground of the large view at the bottom. By this machine hot air is used to warm the leather thoroughly through, and so soften the oil and tallow with which it has been curried. The operator, after putting the wet boot on an arm of the machine, passes it on and adjusts another, until, when twelve boots are thus placed, the first one has come round to him again, sufficiently warmed and dried to be ready for the final rubbing, after which it goes to the packer. The amount of heat usually applied is only about one hundred degrees, though this can be regulated at pleasure, and the better feeling and fine finish which this process gives to the leather are easily perceptible. The hand rubbing is also materially lessened, as is the work of taking out and putting in the feet, and far less space is required for drying than is called for under the old system.

Our illustration gives a view of the machines as they have thus far been constructed, but patterns are now being made for a new style of table, in which the trees are so arranged by a slotted joint that they may all hang down instead of being rigidly extended in their circuit as at present. A company has been formed for the introduction of these machines under the title of the Hot Air Boot Tree Manufacturing Company.

In all the work of a modern shoe factory, two points stand out in marked prominence. One is the extreme care which is taken in the cutting of stock, not only to see that there is nowhere any waste, but to have every piece of leather, so far as the best experience can effect the object, worked up into just the part of a boot or shoe for which it was intended when the leather was bought. The other, and equally important point is the minute division of labor.

It has often been said of late years that there are no shoe makers now as we used to know them in former times, and this is to a great extent true, for but comparatively few of the workers in shoe factories now know more than one or two special details of the work. But this limiting of their labor has made them especially skillful therein, and machines have been devised for nearly every separate operation. In the boot and shoe manufacture Massachusetts has always been almost immeasurably ahead of every other section of the country, and Boston is by far the largest market for boots and shoes in the world. There were shipped from there during 1880 over two and a quarter million cases of boots and shoes and rubbers, to interior and coastwise ports, the cases holding from twelve to seventy-five pairs per case, but containing, at a low estimate, over fifty million pairs. But with this vast trade the competition is especially keen, a dollar profit on the cost of twelve pairs of staple boots being considered a fair working basis on the business as it is being done this year, with much of the business being done at even less than this figure. It is, therefore, particularly appropriate, that in one of the two great fairs now being held in Boston, we should have so thorough a representation of an industry so distinctively pertaining to that section, and one in which the people everywhere are so directly interested.

The firm of Houghton, Coolidge & Co., who make the exhibit, run several factories, in different towns, for the production of a variety of leading styles of goods, which are sold in all parts of the United States, their aggregate manufacture not being exceeded by that of any other house in the country, and being materially greater than that of any foreign house. Mr. A. L. Coolidge, being one of the executive committee having in charge the getting up of the fair, proposed and undertook the setting up of the "Model Shoe Shop," when but little time was left to make the arrangements, but in selecting as its superintendent Mr. C. H. Tilton, who was a manufacturer for him in Ashland, Mass., he obtained a practical manager of rare executive ability, and the work has gone on smoothly from the day of the opening in such a way as to form the principal attraction of the exhibition, and be in every way a credit to the originator of the plan and the great industry it so well represents.

Portrait of Columbus.

In the Spanish Colonial Office of Madrid there has lately been discovered a portrait of Columbus, made when the great explorer was about 40 years of age. It represents him without any wrinkles on his broad forehead, with dark, thick hair, a brilliant eye, and a beaked nose. The portrait is in perfect state of preservation and the inscription is intact. It reads: "Columbus Lygur., novi orbis repertor." The size of the portrait is about 16 by 20 inches.

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POTATOES AND THEIR UTILIZATION.

One of the leading qualities of the potato is its extraordinary productiveness, far exceeding that of any esculent with which it can be placed in competition, one authority placing the yield from an equal quantity of ground at thirty pounds of potatoes to one pound of wheat.

In 1870 there were nearly one hundred and forty-four million bushels of potatoes produced in the United States, and certainly much more than that quantity will be gathered this year. In spite of the great market for this staple of food, it very frequently happens, especially in some of the extensive farming districts in our Northwestern States, where transportation rates are high, that overproduction so affects their value as to make the tubers unprofitable to handle, and, as a consequence, thousands of bushels of them are annually lost or thrown away.

In this connection we have been so frequently asked for what purposes other than as a food the potato can be utilized, that we will endeavor to answer the question.

Potatoes are composed very largely of starch and water, their average composition in northern latitudes being: Water, 75 per cent; starch, 21 per cent; albumen, cellulose, fat, and salts, 4 per cent. The water can be expelled by exposure to heat at a temperature of about 212° Fah., the residue having the composition: Starch, 83·8 per cent; albumen, cellulose, fat, and salts, 16·2 per cent.

Nearly the whole of the starch can be separated from potatoes by simple and inexpensive mechanical operations, and as starch is a commodity for which there is always a good market, and as it can be stored for an indefinite time without danger of deterioration, it is obvious that potatoes may be profitably utilized in the production of starch.

The plant required to make marketable starch is quite simple and easily constructed by any intelligent farmer—a wire basket to wash the tubers, a rotary rasping machine, a few large tubs or watertight hogsheads, some wire and hair-cloth sieves, and a drying room, comprising the principal pieces.

A simple rasping machine is shown in Fig. 1, and consists of a band wheel, A, over the rim of which has been secured, rough side out, a piece of sheet iron previously roughed up like a nutmeg grater by punching it full of holes with a blunt-pointed tool. The wheel is mounted on an axle supported by the wooden frame so as to revolve immediately beneath the mouth of a metal-lined wooden hopper, B.

A more effective rasper or grinder is shown in Fig. 2. It consists of a cylinder, *c*, twenty inches diameter and two feet long, mounted on an axis. It is armed with steel saw plates placed about three quarters of an inch apart, parallel with the cylinder, and having small and regular teeth. The plates are held in position by iron clamps, so that the toothed edges project about four-fifths of an inch from the periphery of the drum. It is driven at the rate of about eight hundred revolutions per minute before the hopper, and is capable of pulping about forty-eight bushels of potatoes an hour. In both these machines the rasping surfaces are kept clean by the action of small jets of water projected with some force.

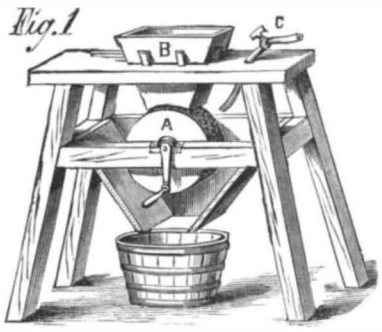
As the washed potatoes are passed through one of these machines the pulp and wash water is run off into tubs, and after the coarser particles have been deposited, the milky liquid is drawn off into other tubs and the starchy matter allowed to settle. Or, as in large factories, the pulp may be rubbed and washed through a series of sieves, ranging from coarse wire gauze to fine hair cloth. After repeated washings with fresh water in the tubs to separate the gummy and fibrous matters, the starch granules are finally allowed to settle, and after the water has been drawn off the pasty mass of starch and water is run off into long wooden troughs, slightly inclined, wherein the paste gradually hardens as the water drains off. When hard enough it is cut into blocks and put on shelves in a warm room to dry out. With good management from seventeen to eighteen pounds of clear starch can be obtained by these simple means from one hundred pounds of average potatoes, which could be disposed of in bulk at present prices.

Starch is not only used for "starching" and sizing fabrics and for various food preparations, but also for the manufacture of grape sugar, glucose sirup, gum dextrine or British gum, and alcoholic liquors. When gradually heated in the dry state to about 160° Fah., in a rotating cylinder similar to a coffee roaster, and kept at that temperature for a short time, the starch is transformed into a gummy substance called dextrine or British gum, soluble in cold water, and extensively used as a substitute for gum arabic.

When boiled for a few hours with water containing a small quantity of sulphuric acid it is gradually transformed into grape sugar or glucose—a kind of sugar extensively used by confectioners, brewers, distillers, and wine makers. The acid used is removed from the sweet solution by adding to it the proper quantity of chalk or lime with which the acid forms an insoluble substance easily separated.

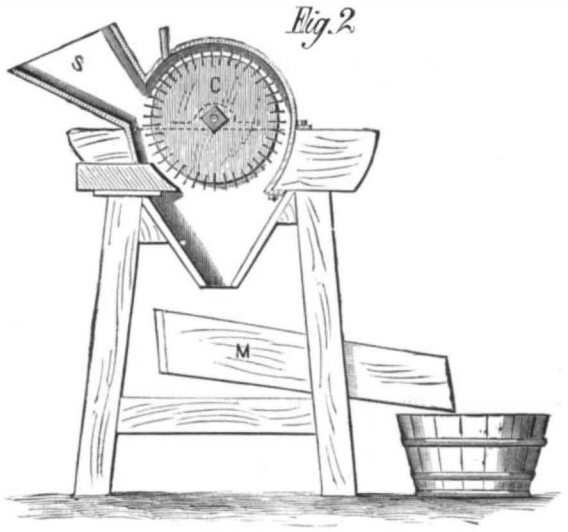
Whisky can be made directly from potatoes. The potatoes, after being finely mashed with boiling water are mixed with about five per cent of malt, the diastase of which on standing converts the starch into grape sugar, one and one half or two per cent of yeast is then added, and the fermentation allowed to proceed at a temperature of about 80° Fah., until the sugar has been converted into alcohol and carbonic acid. The alcoholic liquid when submitted to distillation yields whisky—one bushel of good potatoes yields about seventeen pounds of the liquor. The fermented potato mash can also be converted into a vinegar by allowing the fermentation to continue after the sugar has all been changed to alcohol, or more rapidly by passing the alcoholic liquid through an *Essigbilder* or quick vinegar apparatus. A cheap apparatus of this kind may be made from a large barrel, as shown in Fig. 3. The barrel is provided with a perforated false bottom at *a*, and a tight shelf at *b*. Birch shavings soaked in good vinegar are loosely packed into the space between the shelf and false bottom. The shelf is perforated with a number of

Fig. 1



small holes, through each of which is drawn a few strands of packing thread knotted at the top so as to loosely close the hole, *d d d*; in the figure are short pieces of glass tubing secured in larger holes in this shelf. Around the sides of the barrel, just above the line of the false bottom, are pierced a number of air holes. When a warm alcoholic liquid is poured over the upper shelf of this apparatus it gradually trickles down through the pack thread and over the shavings, where it is brought into intimate contact with an upward current of air from the air holes below to the glass tube exit above, and is gradually changed into vinegar which

Fig. 2



collects in the portion beneath the false bottom and flows off through the curved siphon tube, *g*. If the barrel is small it is usually necessary to pass the liquid through the apparatus three or four times before acetification is complete.

Recently a company has been formed in California for preparing (among other things) desiccated or dried potato. The drying is accomplished by passing a current of dry air, at a temperature of about 140° Fah., over the potatoes, cut in very thin slices, in kilns or ovens provided with a system of movable shelves. Doubtless a large demand for such an article would not be difficult to develop.

Fig. 3

Boiled (dry) potato mixed with zinc chloride and barytes has been used to form an imitation alabaster and coral-like composition.

AGRICULTURAL INVENTIONS.

An improved arm seeder has been patented by Mr. Philip Strong, Jr., of Saranac, Mich. This device is to be carried or worn by the person using it, by means of which all kinds of grain or seed may be scattered or sown broadcast over the ground evenly and with less exertion than heretofore; and the invention consists, principally, of a bag having a flexible tube or smaller portion connected to a sectional metal distributer, which is provided with a valve, and adapted to be swung from side to side for throwing and scattering the grain, the supply of grain from the bag being regulated by means of the valve.

An improved cotton chopper has been patented by Mr. Jay J. Johnson, of Aberdeen, Miss. The object of this invention is to facilitate the chopping of cotton and other drilled plants to a stand.

An improved fence has been patented by Mr. Jesse M. Womack, of Log Town, La. The object of this invention is to economize space and material and produce a substantial and durable fence.

An improved cotton chopper has been patented by Mr. Friederich A. Helmecke, of Round Top, Texas. This invention consists in a novel construction and arrangement of devices for raising and lowering the hoes and throwing them in and out of gear.

An improved harrow, patented by Mr. Benjamin Jones, of Orange, Ill., has a series of long stationary beams, a series of short stationary beams interposed between the rear parts of the long beams, the connecting cross bars, and moved by crank rods pivoted to the stationary beams.

The Great Fires in Michigan.

While the loss of life during the terrible fires in Michigan, during the first week in September, proves to be less than was at first estimated, the resulting distress is far greater than any one supposed possible. The state of the afflicted communities is accurately described in the proclamation of Governor Jerome, dated Detroit, Mich., September 15. He says:

"Portions of four counties of this State, lying principally between Saginaw Bay and Lake Huron, have been devastated by forest fires. A drought, almost unprecedented in this section of the country, had prepared the way for the calamity, and houses, barns, fences, crops, cattle, agricultural implements, household furniture, clothing, and human life have been destroyed by its ravages. In some townships the destruction is complete, and only a picture of ruin left. It is known that more than 200 lives have been lost by burning and suffocation. Many individuals have become helpless through injuries and exposure, and some are blind. The number of men, women, and children left without shelter is estimated at 15,000. The benevolence of the citizens of the State responded promptly to the first necessities of these afflicted people, but ample time has now elapsed, and sufficient details have been received to make it evident that a wider appeal is needed. The destitution prevailing in the suffering counties is appalling. Entire neighborhoods are involved in a common calamity, and cannot help each other. Sufferers have no provisions, except such as are brought from a distance, and no utensils to cook with. Necessaries of life, both large and small, have been destroyed. They need shelter, clothing, shoes, cooking stoves, kitchen utensils, beds and bedding, wagons, harness, plows, hoes, tools of all kinds, seed for future crops, and whatever helps to make men self-supporting."

Four days later, after traversing a large portion of the burned district, Governor Jerome announced that his estimate of the loss of life and the number of sufferers was not exaggerated.

The burnt district covers a territory of about 1,800 square miles, about one half of which escaped the flames; the other half is a blackened waste, the destruction of property being pretty evenly distributed over the whole territory. It was an agricultural country, with occasionally a village or small business center, where were flouring mills, sawmills, stores, churches, etc. Many of these places and their industries were wholly destroyed, and in the farming portions, in the track of the fire, nothing is left for man's use but the land. Barns, cattle sheds, and structures of every kind that remain are being utilized as temporary shelter for the homeless. Hospitals for the care of those who suffer from burns are already established.

Any one who has had experience of forest fires on a considerable scale will be able to frame a faint conception of the terrible whirlwind of flame that burst upon the Michigan settlers that fatal morning. Words are inadequate to convey any idea of it.

The Governor says further:

"The aid extended to the unfortunate by those whose homes were saved will soon exhaust the surplus of the latter. What these people require is aid to procure such necessities as will enable them to live upon and till their lands. They must have food until the harvests of 1882 are gathered. Anything short of this will fail to accomplish the undertaking.

"The first effect of this disaster was to stupefy or paralyze the energies of these people. The prompt aid and encouragement received have stimulated them to new efforts to help themselves. With the bare land and their labor only left they begin to build anew. Already many are constructing log houses, and every available team is being worked with vigor to put in wheat, the seed for which is furnished by the relief committees. They appreciate their condition and the necessities for labor, and will struggle hard to do their part as they have the opportunity."

The attention of the public has been diverted somewhat from the Michigan sufferers by the national affliction through the death of the President. It has been suggested that the materials used in draping dwellings and business places be contributed to the victims of the fire. Very much of the material may be made useful for clothing, bedding, and other household purposes; and liberal gifts of clothing and money would be likely to accompany such contributions. Winter is fast approaching, and what is done should be done speedily.

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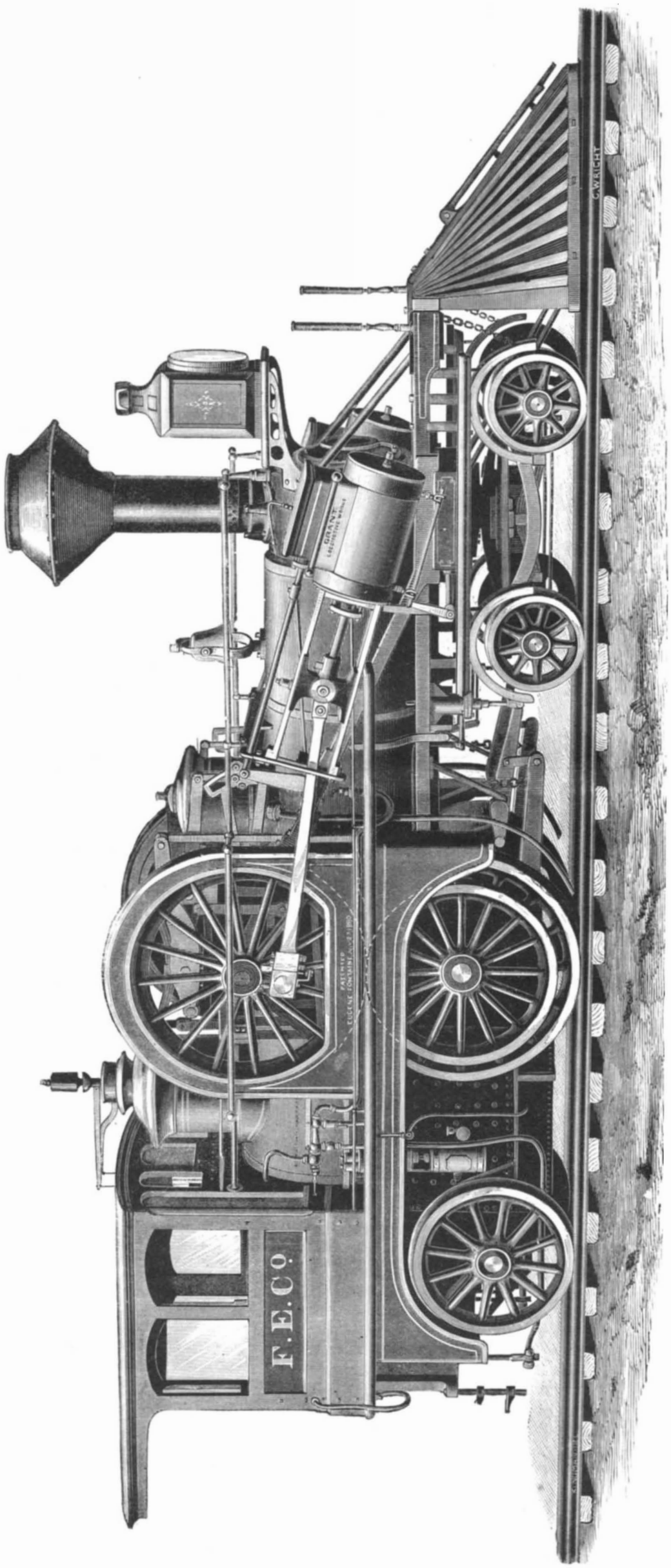
THE FONTAINE LOCOMOTIVE.

We present an engraving of the Fontaine locomotive, which is just now attracting considerable attention in engineering circles. This machine has been in practical use for some time on the Canada Southern Railway, and is credited with being capable of attaining a speed of ninety miles an hour. The second engine of this class was lately turned out of the Grant Locomotive Works, at Paterson, N. J., and is to be tested for two weeks on the New York, Lake Erie, and Western Railroad before it is shipped to its destination.



THE FONTAINE LOCOMOTIVE, BUILT BY THE GRANT LOCOMOTIVE WORKS, PATERSON, N. J.

The peculiarity of the engine is that it has two sets of driving wheels, one on top of the other. The main driving wheels in the Fontaine engines are secured to an elevated axle, above the boiler, and running in boxes supported by a suitably braced frame, the cylinder and slides being set obliquely and in a diagonal line to the axis of the driving axle. The driving wheels are of the usual construction, but do not touch the rails. Resting on the rails are other driving wheels of the same size as the upper ones, with which there is a frictional contact. There being no resistance, when motion is communicated to the upper wheels, the same motion is transmitted to the lower ones by friction. The lower wheels are constructed with two treads, the periphery resting upon the rails, and the other supporting the upper wheels.

To prevent slipping, an air pump is employed, which is operated from the cab, and which acts on a system of levers, by means of which the frictional contact between the upper and lower drivers is diminished or increased, as occasion may require, without disturbing the bearing of the lower wheels on the rails. The engine is also provided with an equalizing truck, so as always to preserve the bearing on the rail.

With this improved construction the running speed may be materially increased without increasing the number of reciprocations of the pistons, and the parts are so arranged that the center of gravity of the locomotive will not be so elevated as to render it liable to leave the track in turning curves.

An increase of the speed of locomotives as ordinarily constructed can be attained only by an enlargement of the driving wheels, or by an increase in the number of the revolutions of the pistons. To enlarge the drivers beyond a certain limit is found objectionable, since by so doing the center of gravity of the locomotive is so elevated as to cause a swaying or gauge motion, and the locomotive is liable to leave the track, especially on curves; and it is found impracticable to materially increase the number of reciprocations of the piston, except at the expense of fuel and a possible straining of the boiler to carry steam at such a pressure as to overcome the backlash or expansion of steam in the cylinders, which cannot, under such circumstances, escape with sufficient rapidity through the ordinary exhaust ports.

In the Fontaine locomotive these difficulties are overcome. We give below a table of the principal dimensions, for which, as well as for our engraving, we are indebted to the *Railroad Gazette:*

Gauge of road	4 ft. 8½ in.
Total wheel base	21 ft. 5 in.
Total weight of locomotive in working order	62,000 lb.
Total weight on driving wheels	32,000 lb.
Diameter of driving wheels	70 in.
Diameter of upper friction wheel	72 in.
Diameter of lower friction wheel	56 in.
Diameter of truck wheels	42 in.
Diameter of cylinder	16 in.
Stroke of cylinder	24 in.
Outside diameter of smallest boiler ring	48 in.
Size of grate	62⅛x33⅝ in.
Number of tubes	140
Diameter of tubes	2 in.
Length of tubes	11 ft.
Square feet of grate surface	14½
Square feet of heating surface in fire box	100
Square feet of heating surface in tubes	806
Total feet of heating surface	906
Exhaust nozzle—single or double	Double.
Diameter of nozzle	3 in.
Size of steam ports	12x1¼ in.
Size of exhaust ports	14x2⅛ in.
Throw of eccentrics	5 in.
Outside lap of valve	¾ in.
Inside lap of valve	None.
Size of main driving-axle journal	7½ in.
Size of truck-axle journal	5 in.
Capacity of tank	2,000 gallons.

RECENT INVENTIONS.

An improvement in tooth brushes, patented by Mr. Roger S. Tracy, of New York City, relates to tooth brushes having removable pads or brush portions, and the object is to provide a simple, convenient, and inexpensive article of that character.

Mr. Ernst Schultz, of Berlin, Prussia, Germany, has patented a compound for cleaning and preserving polished wood surfaces, consisting of linseed oil, olive oil, mastic, sulphuric ether, tincture of benzoin, oil of turpentine, tincture of curcuma, and nitro-benzole.

An improved grate for stoves has been patented by Mr. John Straszer, of Manchester, Mo. This invention relates more particularly to wood burning stoves of the form known in some localities as the "Tod" stove. The improvement consists in combining a lugged and ribbed reciprocating grate with a stationary grate.

An improved machine for rolling and turning logs has been patented by Mr. William E. Hill, of Big Rapids, Mich. This is an improvement on the construction of the machines for rolling and turning logs for which letters patent No. 233,755 were issued October 26, 1880, to the same inventor.

An improved machine for bending and flaring barrel hoops has been patented by Mr. Erastus Hibbard, of South Barre, N. Y. The object of this invention is to furnish a hoop which will have the proper flare to fit a barrel or tub, and will be of nearly the same thickness at both edges and ready for application to a barrel without work upon it by the cooper; and to construct a machine for manufacturing such hoops, the machine being capable of making the hoops of uniform size, and bending and flaring them at the same time.

Mr. Louis C. Graupner, of Red Bluff, Cal., has patented an improved blind-finishing machine which will bead, rabbet, and joint blinds rapidly and accurately, leaving the side edges of the blind parallel. It can be readily adjusted to operate upon outside blinds or upon inside blinds, rabbeting one edge and making the other edge knuckle-jointed or of any other desired shape.

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NEW INVENTIONS.

A device for holding a cuspidor, in connection with a chair or other article of furniture, in such a manner that it can be used very conveniently when desired, but is concealed when not in use, has been patented by Mr. Willard F. Wellman, of Belfast, Me.

Mr. Adrian C. Selby, of Maysville, Ky., has patented an improved soap that is adapted to all of the household uses, for cleaning clothing and fabrics, furniture, tinware, and for toilet use, the properties of the soap being such that it will remove grease, ink, and iron stains from fabrics without changing their color and causing the colored figures of the fabric to run upon the lighter ground. This soap is composed of sal soda, unslaked lime, soft water, bar soap, resin, alum, borax, benzine, salt of lemon, and cream of tartar.

Mr. George Wolfe, of Peoria, Ill., has patented improvements in earthenware pans, such as sauce and stew pans, which have their bails attached in a substantial way, and are so constructed that they are not damaged or broken by the action of the excessive heat. The invention consists in the peculiar means for connecting a bail to such earthenware pan, and in constructing the bottom of the pan with a series of spirally radiating ridges which are of greater depth as they approach the outer edge of the pan, so that the outer surfaces of these ridges rest in a plane, while the bottom of the pan is slightly curved, giving a slightly rising course to the air currents as they circulate outwardly from the center.

Mr. Orrando P. Dexter, of New York city, has patented an improved instrument for dividing and subdividing circles and angles. It consists in an instrument combining a series of bars or arms pivoted to a common center, and slide links connecting the bars.

A lunch box, in which tea, coffee, and other liquids can be carried and heated, has been patented by Mr. Henry B. Dummer, of West Troy, N. Y. The box is provided with double bottom and sides forming a space or chamber all around the box for holding liquids, which chamber is closed at the top, with the exception of an orifice through which it may be filled and emptied, the orifice being provided with a suitable stopper for preventing the escape of the liquid.

An improvement in railroad switches has been patented by Mr. Abraham Ayres, of New York city. The object of this invention is to simplify and cheapen the construction of the kind of railroad switches that are operated by the weight of the car horses.

Mr. John T. Crowther, of Carbondale, Ill., has patented an improved dumping car to run upon rails. It may be used in building railways or for carrying ore or coal at mines, or for loading or unloading grain, and for various other purposes.

Mr. Daniel B. Smith, of Topeka, Kan., has patented an improved car coupling formed of a draw-bar provided with an arm on which a lever is pivoted having a block sliding on an upright of the draw-bar suspended from its inner end, the coupling pin being attached to this sliding block, which is connected by a chain with a beveled link guide pivoted to the draw-bar, so that this link guide will be raised to the outer end of the draw-bar when the coupling pin is raised thus guiding the link into the aperture of the draw-bar.

Mr. Hans J. Müller, of New York City, has patented certain new and useful improvements in electroplating circuits for the purpose of preventing the secondary current of the plating bath from reversing the polarity of the machine. The invention consists in a third or separate line which leads from a piece of carbon or other electric conducting material to the inner positive end of the magnet wire or to a post connected with the end of the magnet wire.

Mr. Joseph H. Wright, of New York City, has patented an improved form of pencil holder for use as an attachment of writing desks. The body of the holder is a box or hollow cylinder having a funnel-shaped or flaring tubular extension to receive the pencil, and adapted for attachment to a desk or some appendage thereof. The cylinder contains a spring reel similar to those employed in a certain class of curtain roller attachments, and the pencil is connected with the reel by means of a cord that is quickly drawn off or wound up, according as the pencil is required for use or not.

Mr. Samuel E. Rusk, of Croton-on-the-Hudson, N. Y., has patented a novel telegraph relay and main line sounder; and it consists, essentially, of a permanent magnet having a movable pole extension surrounded by a helix, the pole extension projecting between the poles of a second permanent magnet and carrying the movable contact of the local circuit. The invention also consists in a local circuit, including a certain amount of resistance additional to that of the sounder magnets, which is either short-circuited or put wholly in the local circuit by the action of the relay.

Mr. William Russell, of Kilmarnock, County of Ayr, North Britain, has patented an improved apparatus for use in the manufacture of Scotch bonnets, etc. The invention consists of an improved "jack" to fashion or shape knitted fabrics while being woven or knitted by a straight bar hosiery frame into circular shaped fabrics.

An improved ice cutter has been patented by Mr. Peter D. Falardo, of Cohoes, N. Y. This invention relates to machines that are operated by steam engines for cutting ice on ponds, rivers, and lakes. It is designed for cutting ice blocks lengthwise and crosswise.

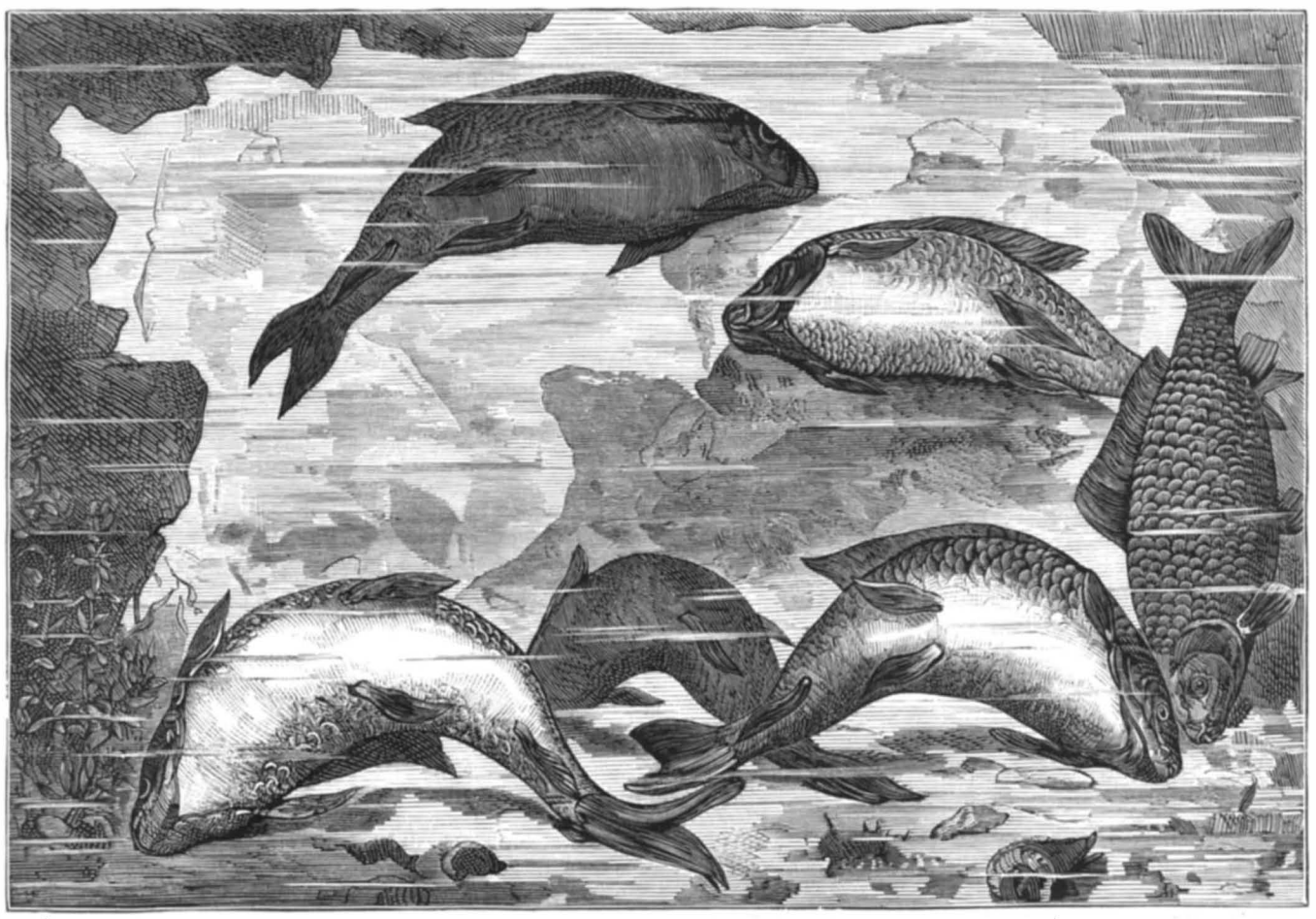
An improved door and window securer has been patented by Mr. William Seeman, of Honesdale, Pa. The invention consists in constructing a window sash fastening with two plates attached to each other at their lower ends and connected at their upper ends by a swiveled screw, and the pawl hinged to the upper end of one of the plates, whereby the fastener can be adjusted to the size of the space between the sash and casing, and can be made to secure both sashes.

Mr. Thornton F. Williams, of Lower Cascades, Oregon, has patented an improved revolving dip net for catching fish as they are ascending streams. It is simple in construction, automatic, and adjustable to the height of the water.

Mr. Henry D. Hurley, of Weedsport, N. Y., has patented a convenient and efficient device by which eggs may be tested by means of a stream of light, the eggs being contained in a dark chamber.

Mr. James Baldwin, of Huntington, Ind., has patented an improved ink well which cannot be upset, preserves the ink in good condition, and is simple and convenient.

Mr. John Turner, of Springfield, Ill., has patented an improvement in sulky plows, the object of which is to lock the forward end of the plow beam of a sulky plow automatically when the plow is raised from the ground.



SLEEPING FISHES.

SLEEPING FISH.

Since the invention of large aquariums the inhabitants of the marine world have been carefully studied in their native element, and many interesting observations and important discoveries have been made. The Berlin aquarium is especially well arranged for the scientific study of fish life, and lately it has settled a much disputed point.

"Do fishes sleep?" has often been asked, but never authoritatively answered. Older investigators denied the possibility, but lately this opinion has been changed in consequence of the following facts.

Generally the life of a fish is more simple and monotonous than that of animals or birds. The fish devotes its time entirely to seeking nourishment. It does not regularly hunt its prey, though it is known that it is much more active at some times than at other times when it seems to rest quietly. This active state is more frequent, as even when the fish is apparently playing at rest it is still ready to seize on any passing prey; but when tired or satiated it remains quiet in a way that resembles the sleep of the beasts of prey.

Generally fish hunt night as well as day; indeed some only commence their activity with the twilight, and rest during the day, in certain places, either lazily floating in the water or hidden in the mud, their belly only visible. These facts have been lately proved by Dr. Hermes and others.

In one division of the Berlin aquarium were about a dozen carp (*Caprinus carpia*) that commence in October to act curiously. From time to time the majority of the fish, occasionally all of them, would assume a crooked position (see engraving), and remain so for hours, or until they were disturbed. When worms or other food were thrown into the water they would spring up to seize it and immediately resume their old position. These fish were often very particular in choosing their resting places. Some would examine carefully with their heads the surrounding rocks and stones, then slowly turn themselves over on the right or left side, and either remain quiet or swim away to seek some other place. Other fish would lie on the gravel, resting on their heads and tails, in the form of a bow. One carp always stood on its head with its body erect in the water—a veritable wonder of balancing that showed the capabilities of its fins. It was easy to arouse most of the fish by means of food or of a noise, but some of them slept so soundly that it was only possible to disturb them by hitting or shaking them repeatedly. The lidless, always-open eye of the fish makes it difficult to distinguish its sleep from its periods of ordinary rest, but this last experiment was conclusive.

The suggestion that this behavior is the result of illness is answered by stating that this habit of sleep was observed nearly every day for more than six months, and during all that time the fish ate regularly, and were free from any appearance of sickness.

It is possible that, as carp bury themselves close together in the mud during the winter, when they are free in the ponds, this behavior in the aquarium was simply their usual winter sleep, modified by disturbances and their altered mode of life.

Improved Tobacco Pipe.

Mr. Jacob H. Van Riper, of 184 Market St., Newark, N. J., has lately patented an improvement in tobacco pipes, the object of which is to prevent the entrance of nicotine and essential oils of the tobacco into the mouth of the smoker, and to retain them in the pipe stem. The improvement consists of a sectional pipe stem having two central sections with large bores or chambers for the condensation of the nicotine and essential oils. These are coupled together with a coupling nut of comparative small bore, provided with reduced terminal central bosses, that serve to retain the condensed oils in the pipe stem, the nut being inserted into the opposite ends of the central sections. In effect this improved pipe stem is a doubly-chambered reversible stem.

The Geographical Congress.

The first session of the Geographical Congress in Vienna—the third annual meeting—took place September 15. Many explorers and other celebrities were present. The congress was opened by the retiring president, M. De Lesseps. The acting president was Prince Teano, president of the Italian Geographical Society. One of the American delegates, Professor Barnard, of Columbia College, proposed a general meridian for all the world with a system of standard time. The plan is to divide the globe into twenty-four meridians of fifteen degrees each, each comparing with the twenty-four hours of the day, the prime or first meridian to pass through Behring Strait, the hours of the day to be counted from one to twenty-four, the A.M. and P.M. of the present system being abolished.

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ENGINEERING INVENTIONS.

Mr. James Manes, of Denver, Col., has patented an improved machine for pulverizing and amalgamating ores. This invention relates to a machine for extracting gold and silver from their ores or from tailings. It consists, mainly, in a series of metal cylinders placed horizontally and made cone-shaped or tapering, so as to be larger at one end than at the other, the said cylinders being provided at their large ends with detachable heads, and being arranged with the large end of one above the small end of the other, and the cylinders being connected by spouts arranged alternately at opposite ends, so that the ore travels by gravity down to the larger end of the cylinder and enters the smaller end of the next subjacent cylinder, and in each of which cylinders is arranged a rotary shaft bearing mullers, brushes, or other devices for pulverizing, stirring, and mixing the ore with mercury or other chemical as it passes through the machine.

Mr. Jacob J. Anthony, of Sharon Springs, N. Y., has patented a new and improved car truck, which is strong and durable, and has a broad spring-bearing for the car body, and which prevents undue wear of the wheels and rails at the curves of the latter.

An improved furnace for steam boilers has been patented by Messrs. Josef Nitsche and Theodor Grellneth, of Vienna, Austro-Hungary. This invention may be carried out in various ways, but the main feature in all is that a part of the air which passes through the grate and is thereby heated, is led to a passage or chamber, whence it, at a certain height above the grate, is made to meet the gaseous products of combustion before they escape over the bridge. The carbon particles which have not been consumed, or the carbon which has only been formed into carbonic oxide and otherwise escaping into the chimney, are thus again brought into contact with the oxygen of the heated air, and thus completely burned.

An improved steam engine valve has been patented by Mr. William Hopkins, of Dubuque, Iowa. This invention relates to that class of valves known as "steam actuated steam valves," that are operated by steam and not by mechanical attachments.

Mr. Robert Holbon, of Alpena, Mich., has patented an improvement in car couplings, which consists, principally, in providing the draw heads of each of the cars with horizontal draw bolts, upon which are pivoted the spring actuated bevel-headed connecting bolts, which may be simultaneously operated from either of the cars for disconnecting the same by means of double-acting tumblers.

An improved side bar for locomotives has been patented by Mr. John R. Fish, of Grand Rapids, Mich. The object of this invention is to prevent the side bars of locomotives from breaking in cold weather. The invention consists in a side bar connecting the driving wheels of a locomotive, having longitudinal strips of wood attached thereto parallel therewith to break the shocks or vibrations caused by irregularities of the track.

A breakwater for protecting harbors and roadsteads, and keeping open channels through bars at the entrances of harbors, the mouths of rivers, and in other places, has been patented by Mr. Alexander G. Follett, of Velasco, Texas.

Mr. Wendel Collin, of Pittsburg, Pa., has patented an improvement in car couplings, the object of the improvement being longitudinal a coupling which will lock automatically, and may be unlocked from the platform, sides, or top of the car. It may be used where the cars differ in height.

Mr. David Nevin, of Silver Cliff, Col., has patented an improved stamp guide for ore mills, which is durable, easily kept in order, and it provides better facilities for taking out stamps and changing and repairing guides as they wear out.

The Absecom Beacon Light.

There are a few great beacon lights on the Atlantic coast that are known by the mariner the world over. One is at Hatteras, others at Cape Ann, Cape Cod, Grey Head, Minot's Ledge, and Nantucket, and another at Absecom. This great Absecom light at Atlantic City, furnished by a Fresnel lens of the first order, which gives a mass of light six feet wide and ten feet high, burns steadily from sunset to sunrise, and can be seen from the deck of a vessel twenty miles at sea. It is a fixed white light, exhibited from the top of a tower 167 feet high, and is visible all round the horizon. To protect the tower thousands of tons of stone and huge dikes are placed on the seaside, but the washing of the waves seriously threatened it, until three years ago a pier was constructed a long distance out to sea, and since then the land has made, removing the beach hundreds of feet away from the tower and the town. About twenty-five years ago a huge package was sold by auction in New York for unpaid custom duties, and brought about $200. It had been consigned in France to a person who had never called for it. Being opened, an immense Fresnel lens of the highest order was found, and this is now the Absecom light. It had cost the Government about $11,000, and they thought it was lost. Let us make this great lighthouse a visit. Major Wolf, the keeper, lives in a modest brick building at the foot of the tower. He is a bird fancier, and has a large lattice-work house near by, with almost a hundred pigeons, many of them carriers, and some of them most amusing tumblers, while over the assemblage presides a solemn wild goose. As we signed the book a pretty little rose-breasted grosbeak, which had been caught in the netting outside the lantern, chirped merrily in its cage. Were it not for this netting the birds flying against the lantern at night might break the glass. As it is many are caught in the netting. The Major said he once caught seven brant at one time, and they had thus captured as many as 300 birds in a single night.

Let us climb laboriously up the winding stairs of the gradually narrowing tower, and count 228 steps as we ascend. It is a tough job even for the keepers who are used to it, and the climber winds around and around the twisted stairway, until he gets almost into the condition of the whirling dervish. The stairway finally comes to an end in a little room beneath the lantern, and on a level with the balcony outside the tower. Here they sit at night serving four-hour watches, and as the tower vibrates in the wind they superintend the light above. We go up into the lantern and see the wonderful construction that makes this powerful light. Imagine yourself in the chimney of a mammoth lamp, ten feet high and six feet across, the central part of the sides made of thick curved glass, and all the rest, top and bottom, of curved prisms acting as a multitude of reflectors. In the center is a large lamp with four circular wicks, arranged regularly one inside the other. Above and below are huge reservoirs of lard oil, with pumps moved by clockwork which regulate the supply. Two gallons of oil are burnt in a night to keep up this artificial sun for the mariner, which outshines any other light that has yet been adapted for lighthouse use.

The view from the top of this tower is grand. Far out to sea the haze over the water obscures the junction of the ocean and sky, but vessels spread their white sails in all directions.

Draining a Bog.

The following account of draining a bog in Holland was furnished the *Times* of London by a local correspondent:

My steps were directed to the well-known reclaimed estate of Mr. Nering-Bölger, called Principell, about two miles from the little station of Mill, on the Boxtel-Wesel Railway.

The entire estate is of 1,500 acres, and cost Mr. Nering £10,000 about twelve years ago, he having paid that sum for it when in the original bog state to the community of Mill. Mr. Nering, in the meantime, went over to North Germany and studied the methods of reclaiming bog lands as followed at or near Osnabrück and Arenberg-Meppen, and other places, and after a careful study of those methods returned home, determined to make the experiment on a bold scale. Bold it certainly was, for in addition to his £10,000 paid down as purchase-money of 1,500 acres of a treeless waste of bog, it cost him £12,000 more in draining, labor, manures, and putting up the requisite farm-buildings, including his own residence. As Mr. Nering truly told the writer, those in Holland who have the money will not enter upon experiments of this kind, and those who have not the money cannot.

The general plan of the estate has been to select 1,000 acres for reclamation, which has been done, while the remaining 500 acres are left for future operations, when Mr. Nering's convenience may permit. In the meantime he prefers to wait the result of his 1,000 acres and the experience he will gain year by year before he attempts to reclaim the remaining 500, which will also supply him with fuel for himself and the fifty men or so who work the farm for him. Mr. Nering commenced operations about eight years ago, by cutting suitable ditches and roads, all in parallelogram form, thus dividing the 1,000 acres into four divisions of about 250 acres each, and each division again subdivided into suitable plots for drainage and cultivation purposes. For each of the four principal divisions Mr. Nering built a suitable farm and outbuildings for stock, etc., and over each division he appoints a farmer, who is put upon his mettle by being made a kind of partner, his remuneration depending entirely upon the results of the land under his care. The whole estate is closely supervised by Mr. Nering himself, assisted by an intendant or bailiff. I, of course, could not see more than the springing crops which, however, seemed quite as backward as in England, many of the fields of oats and maize especially having only just been sown; but the cattle were in capital condition, and Mr. Nering seems inclined to devote himself largely to stock for the development of his estate and for present and ultimate profit. The manure of the beasts is, of course, all used in the cultivation of the land, and as the stock increases, Mr. Nering is enabled to do with less of some of the chemical manures with which he began the experiment after the methods of the Osnabrück and North German school of waste-land reclamation. The land yields capital pasture of grass and clover.

This brings me to the main point of the experiment, viz., the use of chemical manures, which is a method that has only been practicable since the great potash deposit discoveries in the Stassfurth district and Anhalt duchy some dozen years ago, or rather more. Prior to those remarkable discoveries of potash salts in various combinations, the supply of this fertilizing material was limited to costly methods and sources, which made the article too dear for agricultural purposes of this kind, and this discovery may truly be said to have come in time to revolutionize the agricultural procedure in the reclamation of bog land. The method pursued is to dig broad ditches, to drain and to divide the bog into suitable plots, and at the same time to supply the requisite amount of sub sand to put an even layer of four or five inches in thickness on the neighboring plot of bog land. Mr. Nering then spreads upon the sand after a slight working of it his mineral manures in the following proportions—viz., of kainit, which is a double sulphate of potassium and magnesium, about 240 pounds per statute acre, which costs 5s. for 200 pounds, including carriage from Stassfurth. He also uses about 80 pounds of nitrate of soda per acre, which costs him about 30s. for 200 pounds, and then he uses a fair proportion of the more costly, but necessary, phosphate of lime, which he makes himself by first buying bones at about £4 to £5 per ton, and mixing them with sulphuric acid.

Mr. Nering uses large quantities of his farm-yard manure, and finds it better to put the farm-yard manure separately on his land, because of the difficulty of evenly mixing it with the mineral manures. These latter he therefore applies as guano is sometimes or generally applied—that is by scattering it with the hand, thereby insuring a tolerably even distribution. He has experimented with various quantities of the kainit per acre, having used as much as 400 pounds per acre; but as he did not find any proportionate advantage, he of course now restricts himself to supplying only 240 pounds per acre. Mr. Nering suspects that the potash and nitrate soon pass away, from their soluble nature, into the drains, and so into the river. Notwithstanding this, he is amply satisfied with the profitable results of his experiments, which have shown a steady four to five or six per cent on his capital outlay per annum since 1875, although the latter seasons have not been propitious in Holland any more than in the British isle.

In a recent pamphlet Mr. Nering's example is cited as a notable example of the North German and Dutch method of bog reclamation, and the assertion is made that Mr. Nering had realized in one year (1875) a net profit of twenty-two per cent on his outlay. I took the opportunity of calling Mr. Nering's attention to this statement, asking if it were really true, and he at once declared that he had never realized more than the modest four to five or six per cent I mentioned before.

Any way, the truth is that Mr. Nering's experiment is a substantial success, and it is well that the error just mentioned has been discovered and rectified at a moment when the Irish land question is to the front, and when, no doubt, vast sums of the public money will be asked for and probably voted for reclamation of bogs in Ireland. It is of the first importance, therefore, that the facts should be known, both in the interests of the Irish and the other nations forming the British Isles. I especially put the question to Mr. Nering as to his opinion of the conditions requisite to a bog being reclaimable, and yielding a reasonably profitable return. He distinctly gave his opinion that the first requisite is that the land can be drained successfully, and the second that the bog is not deeper than five feet, or six feet at the outside; further, that it should rest on sand or on marl, but not on stiff yellow clay; the marl, to be spread on the surface of the bog, would weather and fall under the frosts and rains, and would, like the sand, give the requisite top-dressing upon which the chemical manures could be spread. But if the bog is more than five or six feet deep, it must be pared down to that depth before there can be a reasonable prospect of profitable reclamation, and if that can be done and the water can be drained away, the experiment, properly conducted, must be a success. Mr. Nering's land is, in fact, a mere skin of turf or bog of from one foot to certainly not more than three feet in depth, and probably not averaging more than two feet, and this rests on a hungry sand such as might have been left on the shore of an estuary.

History of the Screw Propeller.

The erection of a monument to Sauvage, who is believed to be the first to have practically applied the screw propeller to the driving of ships, has given rise in France to a discussion of the true history of the propeller, and the interesting fact has been elicited, says *Engineering*, that it was actually applied on a small scale by Leonardo da Vinci about the end of the fifteenth century. That great artist and engineer endeavored all his life to find a means of flying; and though his admirable studies on the flight of birds are well known, few are aware that he invented several apparatus for elevating man above the ground and wafting him through the atmosphere. All these solutions of the aerial problem are independent of the principle of levitation, and aim at realizing flight by apparatus heavier than the air. Among these numerous plans, which can be seen in the "Codice Atlantico" deposited in the Ambrosian Library of Milan, and also in the volumes belonging to the library of the Institute at Paris, there is the design of a large screw destined to turn round a vertical axis, beside and below which are written some notes in Italian to the effect that the thread of the screw should be of iron wire stiffened with light supports, and covered with linen cloth having its pores stopped with gum. According to the author, when this screw is rapidly turned, it mounts into the air. The design is a very rough one, but it is perfectly clear, as may be seen at page 401 of the *Comptes Rendus* for August 29. We see, therefore, that Leonardo da Vinci in all probability invented the screw propeller, and first applied it to aerial locomotion, thereby anticipating M. Tissandier in his recent application of the same device to a balloon by means of stored electricity. The latter employs bamboo for the framework of his screw, and curiously enough the Italian philosopher also suggests the use of long stout reeds. Moreover, on consulting the "Saggio delle Opere di Leonardo da Vinci," published at Milan in 1872, M. Govi finds that that universal genius had studied the effort exerted in striking the air with plates of a given size, and also invented the well-known parachute, of which a rough design is given, showing the figure of a man clinging to it.

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The Tehuantepec Ship Railway.

While the preliminary works of the Panama ship canal are in progress—though, according to the imperfect information afforded, the progress is very small and the difficulties far greater than were foreseen—Captain Eads is earnestly developing his project for the construction of a ship railway across the isthmus at Tehuantepec. The abilities of Captain Eads, both as an engineer and a financier, have been too well established by the successful completion of one of the great engineering works of the world—the deepening of one of the mouths of the Mississippi—for this scheme to be passed lightly on one side, and pronounced chimerical; on the contrary, emanating from such a source it commands the most serious attention both in a professional and a commercial point of view; it would be at once the most original and boldest engineering work ever attempted, and if successful would have an incalculable effect upon the carrying trade of America, and to a less extent upon that of the whole world. In the United States the question is one attracting great attention, for not only is the work of M. De Lesseps generally regarded with a feeling of mistrust, and with a sentiment of jealousy also, but the route located by Captain Eads lies so much nearer the direct line of travel that it would naturally absorb nearly all the trans-isthmian traffic.

On a subsequent occasion we shall consider this point in more detail, but at present we will content ourselves with a few figures relating to the two routes. Speaking roughly the ship railway route is at the north and the ship canal at the south of the isthmus connecting the two continents, the lines of crossing being about 1,100 miles apart. This is a matter of the utmost importance, especially since Captain Eads has opened for large ships the great waterway of the United States, and converted New Orleans into a vast seaport. A ship leaving the mouth of the Mississippi for California, Japan, or China would, if intending to cross the isthmus by the canal, after passing the site of the railway, be obliged to follow the coast for 1,100 miles to reach the canal, and having crossed, pass up the coast on the western side for the same distance before reaching Tehuantepec. Thus the voyage would be necessarily 2,200 miles further than by the ship railway. This would represent a saving of about nineteen days on a round trip between New Orleans and San Francisco, and a saving of twelve days on a round trip between New York and San Francisco. Shipowners and merchants alike will understand the practical results of such an economy.

Although Captain Eads' project has not yet advanced so far upon the ground as that of M. De Lesseps, it stands upon at least as firm a foundation, and its ultimate prospects are probably far brighter, apart from its physical advantages. The concession granted by Mexico to Captain Eads is a peculiarly advantageous one, the estimate for construction is only £15,000,000, as compared with £48,000,000 for the canal, and if these figures are insufficient, the excess of cost in each case will probably be in the proportion of the estimates; the work could be completed in four years, and there is no doubt as to the amount of traffic which would await the railway on its completion. Naturally the undertaking will meet with much political opposition in the United States, but on the other hand it will meet with widespread and powerful support. The chief opponents will be those whose material interests lie in preserving railway monopolies, and preventing the carrying out of any work which, no matter how vast the national benefit resulting from them, would produce competition and destroy monopoly. On the other hand, support will come on all sides from those who desire the welfare of the country, and who also have great material interests at stake, such, for example, as the merchants of New Orleans now possess. Under these conditions we think there is little doubt but that the United States Government will accord the guarantee asked of six per cent on two thirds of the capital for a maximum term of fifteen years, subject to conditions which throw the whole responsibility on Captain Eads, and also to special advantages which would well repay them for a guarantee which they might never be called upon to redeem.—*Engineering.*

Recent Elevation of the Himalayas.

The superintendent of the Geological Survey, Mr. H. B. Medlicott, and the deputy-superintendent of the same work, have prepared a manual of the geology of India, in two large volumes. With regard to the movements producing the Himalayas the authors say: "During the interval that has elapsed since Eocene times, while no important movements, except small and partial changes of elevation, can be traced in the Peninsula, the whole of the gigantic forces, to which the contortion and folding of the Himalayas and other extra-peninsular mountains are due, must have been exercised. The sub-Himalayan Eocene beds were deposited upon uncontorted Paleozoic rocks; and, although the Himalayan area was probably in great part land at a much earlier period, there is no reason for believing that this land was of unusual elevation, while the direction of the Himalayan ranges is clearly due to post-Eocene disturbance. It will be shown, in the chapters relating to the sub-Himalayan rocks, that the movement has been distributed over the Tertiary and post-Tertiary period; and a great portion is of post-Pliocene date. Indeed, the fact that earthquakes are now of common occurrence in the Himalayas, the Assam hills, Burma, Cutch, and Sind, and that many of the shocks are severe and some violent, while the peninsula area is but rarely affected by earthquakes, may indicate that the forces, to which the elevation and contortion of the Himalayas are due, are still in action; and that the highest mountains in this world owe their height to the fact that the process of elevation is still in progress to a sufficient extent to counterbalance the effects of denudation.

"In Sind and the Suleman ranges, there is much probability that some movement took place during Miocene and Pliocene times. Some slight unconformity between beds, elsewhere conformable, and the absence of different groups in parts of the country, may thus be explained; but the principal disturbance is clearly of post-Pliocene date. To the eastward, in Burma, however, the Pliocene formations of the Irawadi valley are but little disturbed, and the Miocene beds, although contorted, are unaltered; while many of the Eocene and Cretaceous rocks are greatly changed, besides having undergone excessive disturbance and folding. These facts may, perhaps, indicate that the disturbing forces were more severe to the eastward in middle Tertiary times, and that the main action to the westward was of later date; a view partly supported by the fact that there is evidence of elevation having taken place in the Himalayas, near the Ganges and Sutlej, at an earlier period than farther to the westward. In the Simla area there is marked unconformity, due evidently to upheaval and denudation combined, between the Sirmúr and Siwalik series, and between the lower, or Náhan, group of the Siwalik series itself and the next overlying subdivision; whereas farther west, in the Northern Punjab, all the groups follow each other in apparently comformable sequence. The evidence, however, is not sufficient to prove that the contortion to the eastward is older than to the westward; and the absence of any important break in Burma is opposed to the suggestion of great movements having taken place in that country in early or middle Tertiary times.

"It is evident that the forces, to which the principal ranges in the extra-peninsular area owe their direction, have not only been exerted throughout a considerable portion of the Tertiary period, but that these forces have acted contemporaneously, at all events in the post-Pliocene period."

Antarctic Ice.

Mr. Buchanan made experiments on the melting point and amount of salt contained in salt water ice.

He came to the conclusion, from analyses of successive meltings, and the varying of the melting point, that in salt water ice "the salt is not contained in the form of mechanically inclosed brine only, but exists in the solid form, either as a single crystalline substance or as a mixture of ice and salt crystals."

He thinks that by fractional melting salt water ice might be made to yield water fit to drink, although when a lump is melted as a whole the resulting water is undrinkable.

We crossed the Antarctic circle on February 16, passing about six miles to the south of it. There was open water ahead, but the Challenger was not strengthened for ice work, and we were not ordered to proceed further south, so we turned back.

There seemed to be a deep opening in the pack here nearly due south of Heard Island.

We subsequently passed within six miles of what is marked on maps as Wilkes' Termination Land, and found that this did not exist.

Wilkes, no doubt, was deceived by the land-like appearance of distant icebergs.

It is to be noted that he merely says that he saw appearance of land here, sixty miles distant, but high and mountainous. Others have named it for him and placed it on the charts.—*H. N. Mosely, Challenger Notes.*

New Lead Process for the Extraction of Gold from Ore.

The tall chimneys of a large building at the foot of West Fifteenth street, New York city, have attracted some attention of late. An *Evening Post* reporter who investigated the building found that it contained machinery designed to extract the precious metals from ores and tailings by a new process which is said to be a great advance upon all previous methods.

Mr. Hamilton, the inventor of the process, said: "The whole thing lies in the affinity of lead for silver and gold. It was discovered, many years ago, that if into a bath of melted lead you plunge a piece of gold or silver heated to the same temperature as the lead, it will disappear so fast that you cannot see it melt. The extraordinary thing about it is that lead will melt at 630°, while silver only melts at about 2,000°; yet, if you take a bar of silver as thick as your finger, and, after heating it to 650°, plunge it into a bath of lead at 650°, you cannot withdraw it fast enough to save it; whatever part has touched the lead will have disappeared.

"The great trouble that I have experienced in my years of experimenting has been that if I crushed my ore and plunged it into melted lead it would not stay there long enough for the lead to get through the mass of ore to the metal. The ore is about thirteen times as light as the lead, so that it would rise instantly to the top. I could succeed in small quantities, but for practical working in which hundreds of tons of ore would be used every day, the difficulty of mixing together two substances of so unequal density as lead and ore was found almost insurmountable. I think that I have succeeded at last by means of a certain apparatus contained in a furnace of brick and cast iron. The lead has an ample chance to reach each particle of ore and extract all the gold and silver. Everything will be done automatically from the time the ore arrives until the lead containing the gold and silver is poured out to cool. We expect to reduce a ton every ten minutes at a cost of one dollar."

Mr. Hamilton then showed the reporter through the works, in which nearly one hundred men are employed fitting the machinery together. As about thirty-five tons of molten lead are used in this machine, it has to be of the most substantial character. The furnace for heating the ore and the blast fires for furnishing heat are all enormous structures.

MISCELLANEOUS INVENTIONS.

Mr. J. N. Proeschel, of Milwaukee, Wis., has lately patented an improvement in firearms which consists mainly in the combination, with the usual self-cocking lock, of a concealed trigger readily projected from a small guard by a pressure of the thumb or finger. This arrangement, by doing away with the usual open guard and projecting trigger, notably diminishes the bulk and weight of the lock while increasing the safety in handling and carrying the arm. While the invention applies to all firearms, the advantages which it affords when applied to revolvers are especially noticeable. These advantages are, of course increased safety and diminished bulk.

An improved machine for treating grain has been patented by Mr. Charles T. Schramm, of Pontoosuc, Ill. The invention consists in combining an air flue and sliding screens, the flue provided with two openings and hinged plates.

Mr. George W. Logan, of New York city, has patented an improved hat and clothes rack which can be folded very compactly, and the arms of which can be raised, lowered, and locked at any desired inclination very conveniently and quickly.

An improved attachment for cloth-shearing machines has been patented by Mr. David McColl, of Cleveland, Tenn. The object of this invention is to take the curl and slack out of the selvages of cloth, so as to present a smooth, even surface to the shearing cylinder.

Mr. John Brunny, of Fort Scott, Kan., has patented an improved calf and cow weaner. The invention consists in a wire pointed at the end, bent to form a hook, a spring coil, and two angles, and having a pointed wire attached to it in line with its pointed end, the wire bent into a loop at its center, coiled around the main wire, and having its pointed ends projecting. The device is to be applied to the nose of the calf.

Anchor chains are usually connected to the shank of the anchor by a ring or shackle that is held on the end of the shank by a pin or bolt. With that manner of connection the chain frequently fouls with the anchor and prevents it from holding. Mr. John J. Moule, of Fishkill-on-the-Hudson, N. Y., has patented an improved shackle bar for anchors, which prevents anchor chains from fouling without limiting free movement of the chain and anchor.

Messrs. Daniel W. Shaw and Pleasant W. Brown, of Murfreesborough, Tenn., have patented an improved steam engine. The object of this invention is to economize steam and to cause a constant equal pressure or strain upon the driving shaft of the engine. The invention is an improvement on steam engines having more than one movable piston working in the same cylinder, each of which is separately connected with the crank shaft.

Lizzie I. Jones, of Texarkana, Ark., has patented an improved portable bath tub, which when not in use can be compactly folded.

An improved car coupling has been patented by Mr. Nicholas Barr, of Cayuta, N. Y. The invention consists in the peculiar construction and arrangement of the parts, whereby all danger of accident in coupling and uncoupling cars is avoided.

An improved lumber wagon has been patented by Messrs. John G. Seifer and John Maschek, of New Orleans, La. The invention consists, essentially, in a novel construction and arrangement of the reach and connections, whereby provision is made for extending and contracting the length of the wagon to accommodate it to long or short lumber.

An improved thill coupling has been patented by Mr. Clarence J. De Witt, of Havana, N. Y. The object of this invention is to lessen the labor and time required in removing or replacing the thills or pole of a vehicle. It consists in dispensing with the removal of the ordinary bolts, eye-pieces, and rubbers, and providing each thill or pole iron with a loop, through which the projecting end of an eye-piece is passed and secured to the thill or pole iron by a bolt passing through the thill or pole iron and secured by a thumb nut.

Mr. Hiram A. Laws, of Thompson's Station, Tenn., has patented an improved car coupling provided with a lever having double hook at the front end, a fulcrum near its rear end, with a shoulder against which rests the end of a spring for throwing the hooks into engagement.

An improved hoisting machine has been patented by Mr. Henry Field, Jr., of New Bedford, Mass. The arrangement of the parts of this elevator or hoisting machine is such that, by means of a continuously rotating wheel or pulley and link-and-lever mechanism, and friction and clutch mechanism, the action of the machine and the weight will always be under sudden and easy control with the outlay of very little power upon the governing lever.

An improved windmill has been patented by Mr. Isaac M. Steward, of Stromsburg, Neb. The object of this invention is to insure a uniform speed from a variable wind, and also to cheapen the construction of windmills, and economize space.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

New Method of Graining, etc. J. J. Callow, Cleveland, O.

Loud Speaking Telephones, $5 a pair. Illus. circulars for stamp. Agents wanted. W. R. Brooks, Phelps, N. Y.

10 Horse Baxter Engine for sale cheap. Good as new; all improvements. E. J. Morgan, Bridgeport, Conn.

Agencies solicited for Pittsburg and vicinity. Address G. A. Jackson, Washington Ave., 32d ward, Pittsburg, Pa.

Inventor's Institute, Cooper Union, New York City. Permanent free exhibition of new machines, inventions, and patents. See advertisement page 236.

The proprietors of the Boomer & Boschert Cider Press challenge the world to produce another press that will extract the same amount of cider from a given quantity of apples. This press is acknowledged the best made. Their New York Office, 15 Park Row.

Professor Huxley's recent interesting address before the International Medical Congress, London, on the Connection of the Biological Sciences with Medicine, is published in SCIENTIFIC AMERICAN SUPPLEMENT, No. 300. Price, 10 cents.

The Cable Street Railways of San Francisco, with fifteen engravings. By A. S. Hallidie, M.E. A full description of the several street railways of San Francisco, with engravings of the cars, grappling apparatus, and other machinery; also description of all the mechanism, dimensions, grades, results of operations, etc., is given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 298. Price, 10 cents. For sale at this office and at news stands throughout the country. These railways have been worked in San Francisco since 1878 with success, having displaced horses for the propulsion of street cars.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

Foot Lathes, Fret Saws, 6c. 90 pp. E. Brown, Lowell, Mass.

Common Sense Dry Kiln. Adapted to drying all of material where kiln, etc., drying houses are used. See p. 205

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Alden Crushers. Westinghouse Mach. Co., Pittsb'g, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Punching Presses & Shears for Metal-workers, Power Drill Presses, $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N. Y.

Improved Skinner Portable Engines. Erie, Pa.

The Eureka Mower cuts a six foot swath easier than a side cut mower cuts four feet, and leaves the cut grass standing light and loose, curing in half the time. Send for circular. Eureka Mower Company, Towanda, Pa.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Peck's Patent Drop Press. See adv., page 204.

Wood-Working Machinery of Improved Design and Workmanris . Cordesman, Egan & Co., Cincinnati, O.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro. 234 Broadway, New York.

4 to 40 H P. Steam Engines. See adv. p. 189.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N. Y.

Cope & Maxwell M'f'g Co.'s Pump adv., page 189.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts. Importers Vienna lime, crocus, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 204.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 206.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 222.

Saw Mill Machinery. Stearns Mfg. Co. See p. 205.

Supplee Steam Engine. See adv. p. 204.

The American Electric Co. and Proprietors and Manufacturers of the Thomson Houston System of Electric Lighting of the Arc Style. New Britain, Conn.

See Bentel, Margedant & Co.'s adv., page 221.

Silica Paints (not mixed); all shades. 40 Bleecker St., N. Y.

The None-such Turbine. See adv., p. 206.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Telegraph, Telephone, Elec. Light Supplies. See p. 221.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 221.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Gould & Eberhardt's Machinists' Tools. See adv., p. 222.

Safety Boilers. See Harrison Boiler Works adv., p. 222.

The Medart Pat. Wrought-Rim Pulley. See adv., p. 321.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 221.

Engines, 10 to 50 H. P., $250 to $500. See adv., p. 221.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 221.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Av., Phil. Pa.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 220. Totten & Co., Pittsburg.

Combined Concentric and Eccentric Universal and Independent Jaw Chucks. The Pratt & Whitney Co., Hartford, Conn.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) J. A. asks for the best method of putting on tinware the appearance of crystals, such as is seen on window panes in frosty weather. I see a great many trunks ornamented that way now. I have tried acids, but do not succeed. I want to ornament a patented article that is made of tin, to make it more attractive. A. The *moir metallique*, or crystallized tin plates, are usually prepared from well annealed and well tinned charcoal iron plates, by rinsing the plates with dilute nitric or nitro-muriatic acid and then with water. The cleansed plates are dipped for a few moments into nitric acid or aqua-regia (nitric acid 1, muriatic acid 3), diluted with from one to three volumes of water and heated to about 180° Fah., and after a moment's exposure in this bath removed and rinsed in running water. This is repeated, if necessary, until the crystals are properly developed, when the plate is finally rinsed in hot water, which causes it to dry quickly without rubbing. The plates are then oiled or lacquered to preserve them. Plates which have been heavily rolled or too quickly chilled after tinning do not afford a good crystallized surface. Hot tannin or strong caustic soda solutions can also be used to develop the crystalline structure of tin plates.

(2) S. M. S. asks for the best process for bleaching sheepskin parchment white, or nearly so, without leaving streaks and spots or injuring the smoothness and durability of the parchment. A. Expose the pieces to strong sunlight under glass in a moist atmosphere until bleached.

(3) J. N. asks: Would California red wood do to make wine casks, and how could it be prepared that it would not stain the juice? Red wood is much cheaper than white oak staves for casks, and if a way could be devised that would not stain the grape juice, its use in wine making would be very advantageous. A. If the wood were impregnated by soaking it for some time, with a strong, hot aqueous solution of alum, and then (after rinsing lightly) with a hot, slightly alkaline solution of soap, containing a little glue, followed by rinsing in water, so as to fix the color and fill the fibers with insoluble aluminum soap and gelatine tannate, it might be made to serve the purpose of wine-storage vessels very well.

(4) G. B. asks how to soften white lead that has stood four years so as to render it fit for use. A. Break up the hardened paint and triturate it in a mortar (or paint mill) with just enough hot linseed oil to soften it properly, then thin down with oil of turpentine.

(5) A. C. asks: 1. Should a frame house be painted soon after its erection, or allowed to remain for a time unpainted, exposed to the weather? I think, some time ago, you advised the latter course, but I have forgotten the reason you gave for it. A. It is not well to put paint on new woodwork at once, unless the latter has been previously thoroughly seasoned, which is very frequently not the case; and under any circumstance it is well to delay such painting until the new work has been exposed to sunshine and dry weather for a few days. 2. Likewise, should a cistern be covered or allowed to remain uncovered so that the air may get to it? A. Cover the cistern.

(6) J. F. K. C. asks if there is any cheap mode of inscribing on brass, besides engraving. Have seen something of the kind in the SCIENTIFIC AMERICAN. A. Use a fatty ink and a rubber stamp having a negative die. Print the design with this on the metal, let it dry somewhat, and etch away the uncovered parts with dilute nitric acid: water 3, acid 1. Clean off the ink with sand and benzine.

(7) E. R. asks how to prepare leaf tobacco with chemicals or otherwise for cigarette or pipe smoking. It has been packed down one year. I now break up the leaves, then dry in the oven; but it smokes too strong. A. Try the following: Thoroughly wet the tobacco, then pack and put under strong hydraulic pressure, after which spread it out as soon as possible in thin layers to dry quickly in contact with cool dry air.

(8) C. A. S. asks: How much power will the new battery, described in SCIENTIFIC AMERICAN of September 3, develop in connection with an electro-motor? Or how many cells would be required to develop one horse power, constant use ten hours per day? Is there a better battery for this purpose? A. This is a matter of experiment we have not sufficient data at hand to make the required estimate. The Grove, Ladd, Bunsen, and similar forms of battery produce currents of greater electromotive force, but they require very much more space and attention, and cost more to maintain.

(9) F. H. G. asks: 1. What is the best way of preparing a solution for silver plating, and the one least liable to strip? A. The following is a good bath: Soft water, 1 gallon; cyanide of potassium, 8 ounces; nitrate of silver, 5¼ ounces. Dissolve the silver nitrate in a small quantity of soft water, and gradually add, with constant stirring, solution of cyanide of potassium until no further precipitate of silver cyanide forms (avoiding any excess of the precipitant). Throw the precipitate on a fine cotton cloth filter, and as the liquid runs through, wash the precipitate on the cloth with pure water. Mix and dissolve this wasted precipitate with the water in which has previously been dissolved the cyanide of potassium. If the silver cyanide does not dissolve readily add more cyanide until it does. 2. Is it necessary to use pure silver both for making solution and for anodes? What effect does it have if the silver is not pure? A. Yes; if the silver used is impure the bath will be likewise, and it is impossible to obtain a reguline deposit of pure silver from such a bath. 3. What battery is the best for silver plating? A. The Smee form is generally preferred for fine work. See article on Silver Deposits, page 81, vol. xliv.

(10) J. J. R. asks: 1. Can you inform me of any way of silver plating iron or cast steel polished surfaces, without first depositing a copper surface or the usual process of scouring with lava dust? A. See article on Silver Plating, page 81, vol. xliv. 2. Is there not a solution or solutions that remove the saponified grease from the surface of the article to be plated which leaves it immediately ready to receive a deposit of silver? A. Iron and steel can only be satisfactorily freed from the last traces of oxide—after rinsing in hot water on coming from the lye dip—by scouring. If properly pickled and scoured in the first place the pieces will not require much after scouring.

(11) G. P. H. asks how to make a good quality of court plaster. A. Soak isinglass in a little warm water for seventy-four hours, then evaporate nearly all the water by gentle heat, dissolve the residue in a little proof spirits of wine, and strain the whole through a piece of open linen. The strained mass should be a stiff jelly when cool. Now stretch a piece of silk or sarsanet on a wooden frame, and fix it tight with tacks or packthread. Melt the jelly, and apply it to the silk thinly and evenly with a badger hair brush. A second coating must be applied when the first has dried. When both are dry, apply over the whole surface two or three coatings of balsam of Peru. Plaster thus made is said to be very pliable and never breaks.

(12) E. Y. asks how to make a cement for glass that will resist acids. A. Take 10½ lb. of pulverized stone and glass, and mix with it 4¾ lb. of sulphur. Subject the mixture to such a moderate degree of heat that the sulphur melts. Stir until the whole becomes homogeneous, and then run it into moulds. When required for use it is to be heated to 248°, at which temperature it melts, and may be employed in the usual manner. It resists the action of acids, never changes in the air, and is not affected in boiling water. At 230° it is said to be as hard as stone.

(13) X. asks how to mould ornaments for patterns for stoves, vases, etc. A. The following composition is commonly used: Soften 12 lb. of good glue in water enough to cover it, then heat until the glue is dissolved. Melt 7 lb. of resin, ½ lb. of pitch, and 2½ pints of linseed oil together. Stir the hot glue solution into this and add enough whiting to thicken. It should be mixed in small quantities and used at once; otherwise it will require steaming before it can be used.

(14) O. E. M. wants to know how to bleach straw. A. Straw goods are bleached by submitting them to the action of the vapor of burning sulphur—or better, to the vapor of burning bisulphide of carbon. The straw, which must be perfectly clean, must be well moistened with pure soft water before submitting to the sulphuric oxide. The bleaching is carried on in tight wooden sheds. Straw may be bleached by chlorinated lime, but the fiber is liable to be somewhat injured thereby. Moisten the goods thoroughly in a strong aqueous solution of the bleaching powder (defecated), and then pass them through a bath of sulphuric acid diluted with about 20 parts of soft water. Repeat if necessary, and finally rinse thoroughly in water containing a small quantity of sulphur or hypo-sulphite of soda.

(15) A. W. M. wants to know what is the best general antidote to poison. A. If a person swallows any poison whatever, or has fallen into convulsions from having overloaded the stomach, an instantaneous remedy most efficient and applicable in a large number of cases, is a heaping teaspoonful of common salt, and as much ground mustard, stirred rapidly in a teacupful of water, warm or cold, and swallowed instantly. It is scarcely down before it begins to come up, bringing with it the remaining contents of the stomach. And lest there be any remnant of the poison however small, let the white of an egg or a teaspoonful of strong coffee be swallowed as soon as the stomach is quiet; because these very common articles nullify a large number of virulent poisons.

(16) "Photo" asks for a good receipt for retouching varnish. A. In his recent work on retouching, M. Janssen, the *Photo Correspondenz* says, recommends the following varnish: Alcohol (sp. gr. 0·830), 60 parts; sandarac, 10 parts; camphor, 2 parts; Venetian turpentine, 4 parts; oil of lavender, 3 parts. This varnish may also be used for paper pictures. The retoucher should not set to work as soon as the negative has been varnished, as the film will not then be hard enough to bear the touch of a lead pencil. The varnished film is in the best condition for retouching when a day old.

(17) E. J. writes: I am overrun with rats and mice, and as yet have found no remedy. Can you give a receipt for an effective rat and mouse exterminator? A. Try the following: A mixture of two parts of well bruised common squills and three parts of finely chopped bacon is made into a stiff mass, with as much meal as may be required, and then baked into small cakes, which are put around for the rats to eat.

(18) H. E. K. asks for a cheap way (cheaper than by windmill) to raise half of the water from a spring that throws two and a half gallons of water a minute, up to the house five rods distance, ten feet high. A. We know of nothing that will answer your purpose. A hydraulic ram will raise only about one-fourth to one-sixth of the water expended.

(19) L. B. asks: 1. What is the horse power of a horizontal tubular boiler 10 feet long, 42 inches diameter, 36 3-inch tubes? A. Your boiler would be usually called 25 horse. 2. Can I get more power of an engine with a larger fly wheel than a smaller one? I have an engine, 8x12 inch cylinder, and have 5 foot fly wheel, weighs about 600 lb. Can I get more power out of the engine by putting on a larger wheel, and what size; or will it do as well to add another wheel of 600 lb. weight on the other side of the shaft? The engine makes about 140 revolutions in a minute. A. You cannot increase power by more fly wheel. You can only equalize speed. If the power is not uniform it might be well to add another wheel.

(20) P. R. writes: 1. Suppose a sash and its counterweight to weigh 100 lb. each, the pulley to support 200 lb. Then, will the tension on any part of the cord be 200 lb.? If not, please explain. A. The tension on each side of pulley will be 100 lb., and total weight on pulley 200 lb. 2. Why could not the cables of the East River Bridge be kept higher in the middle and consequently the bridge, as the greatest objection is because it is too low; or is it necessary to have a certain amount of sag in the cables? A. To do so would necessitate carrying up the towers to a greater height. The cables cannot be straightened without enormously increasing the strain.

(21) C. C. G. writes: Please inform me approximately the quantity of coal a 25 horse power engine, run to its full capacity, would use in twenty-four hours; also, how much water it would require? A. It depends much upon the character and condition of the engine and boilers. An average would be 100 to 130 lb. coal, and 750 to 950 lb. water per hour.

(22) T. J. M. asks: Why is it that an injector attached to a steam boiler of 12 horse capacity, and running under a pressure 50 lb., will not raise water for feed supply from a well 50 feet deep? Ours has so far failed and a competent (so regarded) engineer says 50 feet is the limit. If this be so what is our best resort to accomplish the work indicated? A. The very best form of injector will not raise (or lift) water reliably, one half of 50 feet. If it would produce a vacuum, it could not be relied upon to lift water higher than a good pump, say 26 or 28 feet. We think your best way will be, to set a pump in the well about 22 to 25 feet above the surface of the water and lift the water into a tank for the injector.

(23) R. E. M. wants to know how to make a plaster cast from the human face. A. Place the subject upon his back, with the head raised to the normal position by a pillow of bran or sand; cover the parts intended to be cast with a film of olive or true almond oil, applied with a feather brush or lump of cotton; plug the ears with cotton wool, and insert two quills or pieces of glass tubing in the nostrils and secure the space around them with cotton. When all is ready mix the plaster of Paris with warm water to about the consistence of cream, and with this cover the face from the forehead downward to the lower border of the chin. The eyes should be firmly closed, but in such a manner as not to cause distortion by too violent compression. Then cover the parts of the chest and arms to be represented, carrying the plaster upwards, so as to join the cast of the face. Then (when properly set) carefully remove each, and soak or brush it with linseed oil boiled with a little sugar of lead or litharge. Instead of casting the face and chest in two separate pieces, it is preferable to make the casting in one piece, and to divide it into 4 or 5 sections before removing, by means of threads placed in position before the plaster is applied, and withdrawn when the latter has nearly set. The cast of the back of the head is usually taken by lowering it (well oiled) into a deep trencher partially filled with the liquid plaster, and the back of the neck with the subject face downward. When the mould is finished it is firmly tied together, the joints plugged with a little cotton wool, well oiled on the inside, and a sufficient quantity of tolerably fluid plaster poured in. When the outer portions of the model have nearly set the inner portions are scooped out, and the whole thoroughly dried before removing the mould. The model is trimmed with a sharp knife. If the eyes are not to be represented as closed they must be carved out from the mass.

(24) G. L. asks how to temper large curved dies for cutting iron and steel plate. A. Fill the holes with fire clay and wire to keep it in place. Heat evenly and slowly in a furnace. Lift the dies from the furnace with the face vertical and plunge vertically into water heated to about 50° and containing about ½ lb. salt per gallon. Hold them still at the bottom of the water until cooled.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. H. H.—1. It is a ferruginous earth mixed with small fragments of broken glass—not metalliferous. 2. We could not undertake to say just what drugs the mixture is composed of, but we can recognize in it flour,

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sulphur, camphor, mustard,and oil.—J. McF.—1. It is a piece of common red jasper with a few crystals of iron pyrites. 2. It is feldspar with a little quartz and hornblende.—R. S.—The clay is very impure—it might be used for the manufacture of cheap red bricks,but would hardly pay to attempt purification for pottery. The other sample has not come to hand.—P. B. O. J.—It is coal shale. The markings observed are those of fossil ferns of the coal period. These shales are quite too common to be of any commercial value.

NEW BOOKS AND PUBLICATIONS.

A PRACTICAL TREATISE ON THE MANUFACTURE OF STARCH, GLUCOSE, STARCH-SUGAR, AND DEXTRINE. By Julius Frankel. Edited by Robert Hutter. Philadelphia: Henry Carey Baird & Co. 8vo, cloth, pp. 344. $3.50.

This, the only volume on the subject in the English language, is chiefly on the work of Professor Ladislaus von Wagner, of Buda Pesth, reputedly the best treatise produced in Europe. It is illustrated by half a hundred engravings, including example of the most recent American machinery. It describes briefly yet fully the history and chemistry of starch, the different methods of manufacturing starch from potatoes, wheat, corn, rice, and other grains and starch yielding substances; the history, literature, technology, and manufacture and uses of starch sugar, dextrine, and allied products; and seems throughout to be well calculated to accomplish its avowed purpose, namely, to advance and improve a group of industries which have suffered from mystery,secret processes, and empiricism, and the lack of progress inseparable from such modes of procedure in any industry.

SPITZLI'S MANUAL AND ILLUSTRATED CATALOGUE. By Alfred Spitzli. Second Edition. West Troy, N. Y.: A. & A. F. Spitzli. 1881. $1.

The catalogue is a fairly comprehensive list of instruments, accessory apparatus, books, etc., for designers and manufacturers of textile fabrics. The manual contains nearly two hundred pages of definitions, derivations, and explanations of technical terms peculiar to textile manufactures, descriptions of the nature and uses of many substances employed in such manufactures, processes, rules, tables, etc. The compiler professes to have no theories to introduce, his aim being simply to present the best authenticated information of value, especially to beginners in textile manufactures.

UNDERGROUND TREASURES: HOW AND WHERE TO FIND THEM. By James Orton. Philadelphia: Henry Carey Baird & Co. $1.50.

A new and enlarged edition of the late Professor Orton's little key for the ready determination of the more common useful minerals. Seventy-seven different minerals are plainly described and the principal places of their occurrence in the United States are named. With a set of illustrative specimens it would make a valuable addition to any boy's or farmer's library. By itself it will enable any intelligent person to make a fair estimate of the probable value of any minerals he may discover.

AMERICAN NERVOUSNESS: ITS CAUSES AND CONSEQUENCES. By George M. Beard. New York: G. P. Putnam's Sons. 12mo, cloth, pp. 352.

In this volume Dr. Beard has presented in the bright and suggestive style which is characteristic of him the observations and opinions already familiar to the public through his lectures and contributions to the periodical press. Unlike most medical specialists he is disposed to take a hopeful view of the maladies he has chosen to study, so far at least as to consider them largely curable and likely to be diminished in severity by the natural progress of American society toward more reasonable and wholesome living.

MENSURATION AND METRICAL GEOMETRY. AN ELEMENTARY TREATMENT OF MENSURATION. By George Bruce Halstead. Boston: Ginn, Heath & Co.

So far as can be judged without working through it with a class of students this treatise appears to be excellently well planned and executed.

SHAKESPEARE'S OTHELLO, THE MOOR OF VENICE. By Rev. Henry N. Hudson. Boston: Ginn & Heath. Sq. 16mo, pp. 209. 65 cents.

The twentieth of Mr. Hudson's edition of Shakespeare's plays annotated for use in schools and families. The editor's rank as a Shakespearean critic is well known. The type and printing are attractive, the paper good, and the size of the volume convenient for holding and carrying.

ELEMENTS OF ALGEBRA. By G. A. Wentworth, A.M. Boston: Ginn & Heath. $1.45.

In the preparation of this school book Professor Wentworth has given abundant evidence of a clear appreciation of the needs of the student as well as of singular skill in the art of book-making.

English Patents Issued to Americans.

From September 6 to September 9, 1881, inclusive.

Coffee beans, utilizing products of, R. S. Jennings, Baltimore, Md.
Electro-magnetic telegraph, A. F. & F. B. Johnson, Brooklyn, N. Y.
Electro-magnetic machines, coiling wire on, Haase & Recker, Indianapolis, Ind.
Electrical apparatus, C. Dion, New York City.
Electric light, W. S. Hill, Boston, Mass.
Faucets, C, Whittaker, Chicago, Ill.
Fire extinguishers, A. Burritt Hardware Company, Waterbury, Conn.
Gas, manufacture of, F. Egner, Norfolk, Va.
Lighting, W. Wheeler, Massachusetts.
Loom shuttles, J. S. Jaques & Co., Lowell, Mass.
Pyroxyline, J. W. Hyatt, Newark, N. J.
Pentograph machines, J. Hope, Providence, R. I.
Penholders and pens, J. G. Hester, Washington, D. C.
Sewing machines, J. B. Anthony, Providence, R. I.
Tin or sheet metal vessels, A. H. Fanchers, Brooklyn, N. Y.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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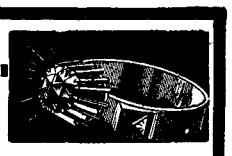

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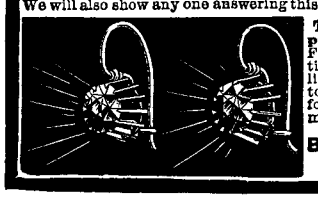

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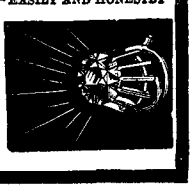

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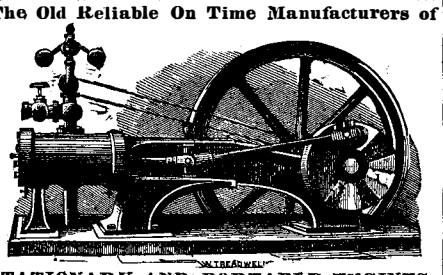

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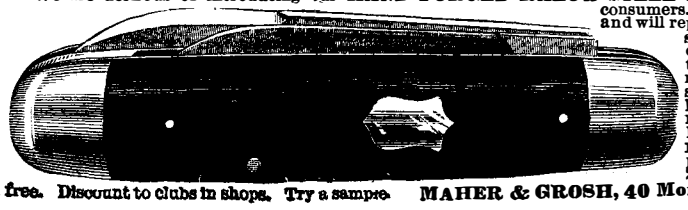

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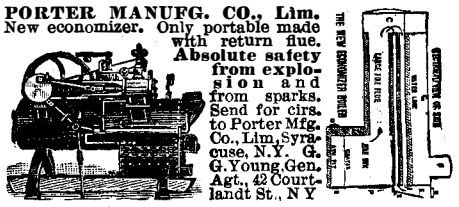

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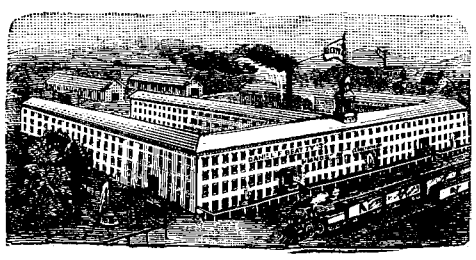

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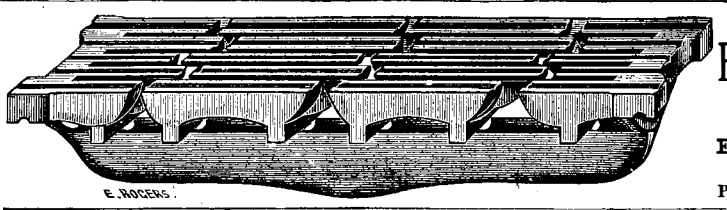

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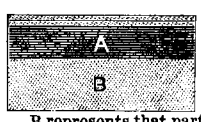

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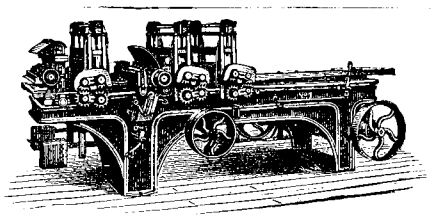

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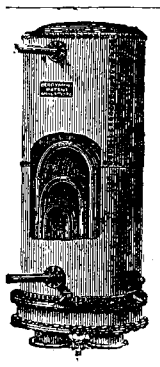

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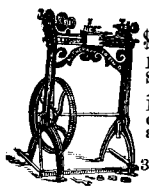

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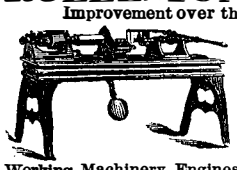

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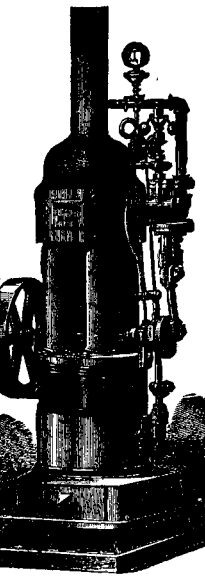

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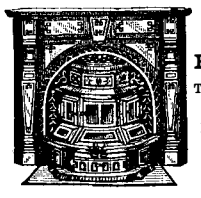

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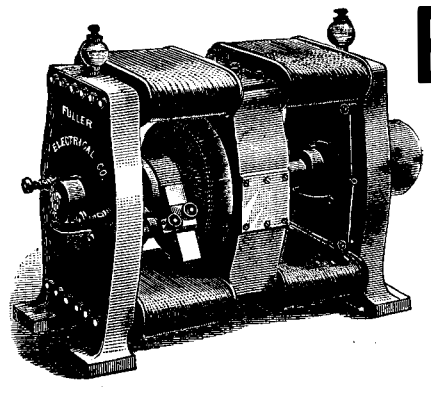

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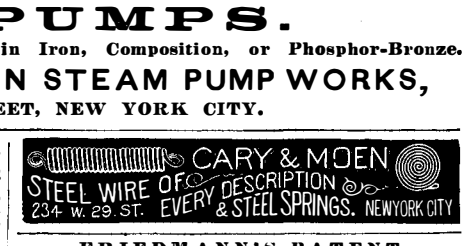

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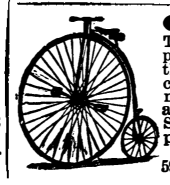

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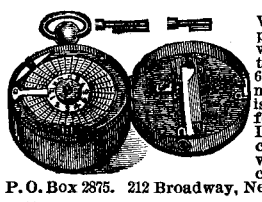

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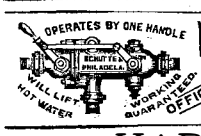

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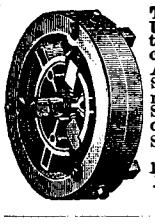

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